MACHINERY

Design—Construction—Operation

Volume 43 | JANUARY, 1937 | Number 5

PRINCIPAL ARTICLES IN THIS NUMBER

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DEPARTMENTS

February MACHINERY will cover a broad variety of subjects, including external threading on tapping machines, recent developments in hard-facing, radiant tube heating for industrial furnaces, and unusual results in up-to-date metal sawing. The tool engineer will be particularly interested in the article *The Tool Supervisor Being Interviewed.*

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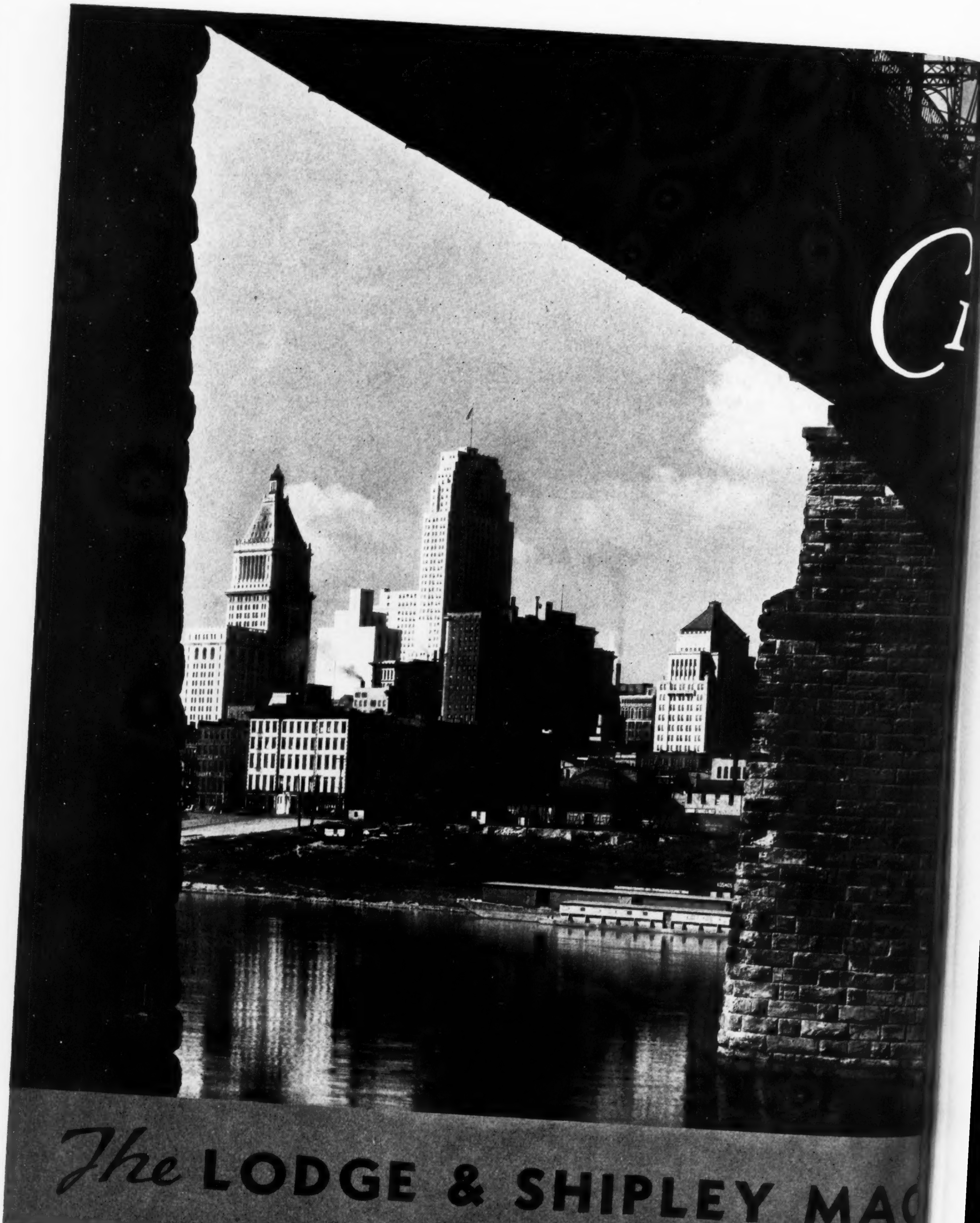


The LODGE & SHIPLEY MAC

MACHINERY

Volume 43 NEW YORK, JANUARY, 1937 Number 5

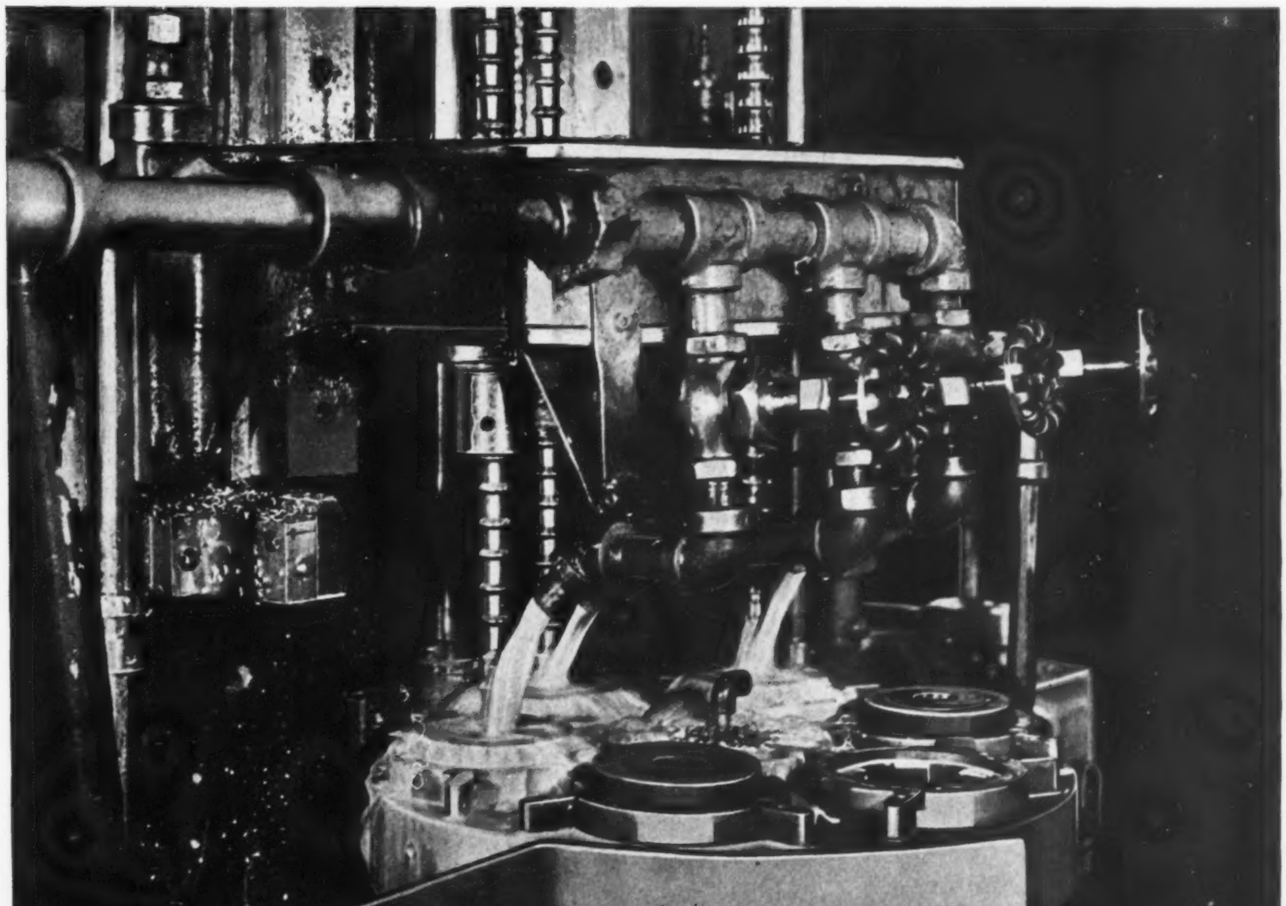
Buick's Broaching Program for 1937

In Progressive Automobile Plants New Cars Invariably Call for New Manufacturing Equipment, Because with Machines, as with Automobiles, the Latest Models are Generally the Fastest and Most Efficient

By CHARLES O. HERB

ONE of the important reasons why the automobile industry led the nation in overcoming the business depression was because it had the courage to spend millions of dollars for the purchase of new manufacturing equipment. Machines that had become obsolete during the period of depression were replaced with equipment that is capable of turning out automobile parts of higher quality than in the past at lower costs.

The executives of progressive automobile concerns have always considered money well spent that kept their shop equipment up to date. They have always been ready to adopt new methods that promise higher quality and greater economies. Broaching, for example, up until a few years ago, was employed in a limited way only in automobile plants, and principally for the finishing of holes. Today broaching is widely used for finishing ex-



ternal surfaces, flat or irregular, and for many additional internal operations that used to be considered impracticable.

Approximately $14,500,000 was appropriated by the Buick Motor Co., Flint, Mich., in preparation for manufacturing the 1937 models and for an extensive new building program now in progress. Added to the $15,000,000 expended similarly the previous year, a total of almost $30,000,000 has been spent for new manufacturing facilities within the last year and a half.

A substantial portion of this investment was applied to take advantage of the production possibilities afforded by the advancements that have been made in broaching equipment. This article will describe some of the most important broaching operations now being performed on Buick parts. All of the machines referred to are hydraulically actuated.

Probably the largest vertical broaching machine that has ever been built is used for cutting helical splines in low-speed transmission gears. This machine, which is shown in Fig. 1, was built by the Colonial Broach Co. and had to be installed in a pit 4 feet deep, in order to clear the ceiling of the shop and to enable the work to be handled conveniently. The gear forgings come to this machine in the rough state, as shown at the left in Fig. 2, and leave with the splines completely finished in the bore, as illustrated at the right.

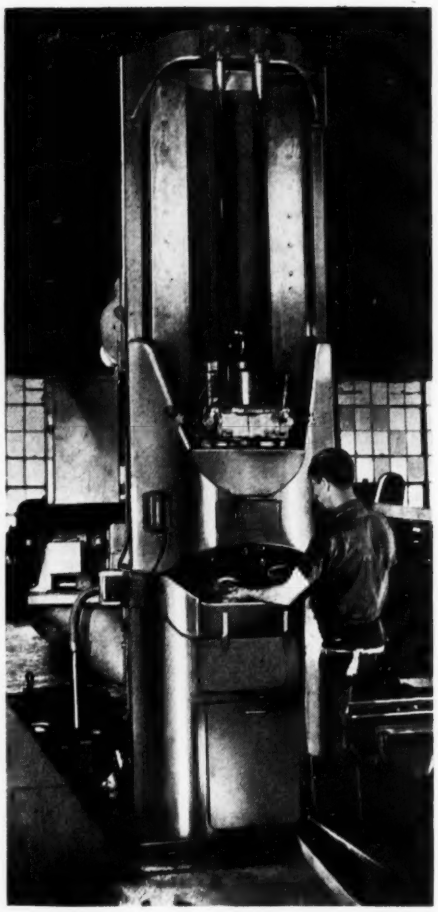
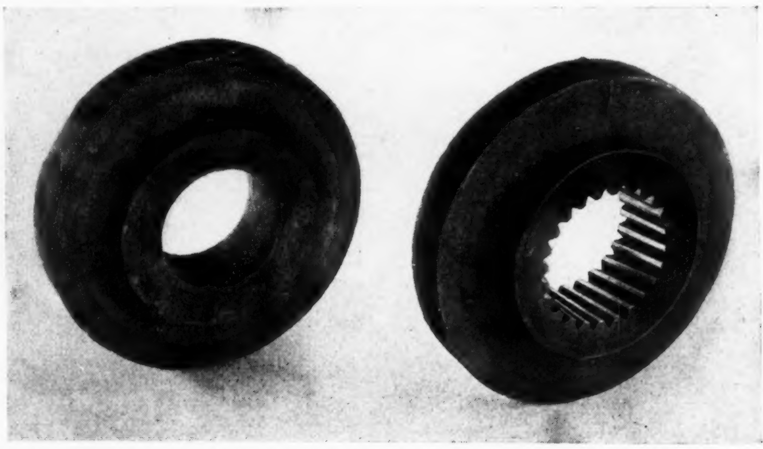


Fig. 1. Huge Machine Used for Broaching Helical Splines in Transmission Gears

Fig. 2. Transmission Gear Forging as it Comes to the Broaching Machine, and as it Leaves with the Helical Splines Completely Finished



There are twenty-four splines of twelve normal pitch, having a lead of 40.95 inches and a helical angle of 8 degrees 49 minutes 31 seconds. The finished internal diameter of the splines is from 1.920 to 1.923 inches, and the thickness of the gear blank at the hub is approximately 1 1/8 inches.

Two gears are broached simultaneously, as seen at *A* and *B* in Fig. 4. Helical broaching to the specified angle is performed by rotating the two broaches as they are pulled upward through the gear blanks. This is accomplished by means of the two lead-screws seen at the top of the machine in Fig. 1, which engage nuts mounted on the ram. As the ram feeds up the face of the column, the nuts are rotated on the lead-screws and, through gears, turn the broaches in accordance with the helix of the lead-screws. Thus the splines are broached in the gears to the same helix angle as the lead-screws.

At the beginning of an operation, the two broaches are disconnected from the upper slide or pull-head and are withdrawn into the lower part of the machine, projecting somewhat above plate *C*, Fig. 4. Two gear blanks to be broached are then slipped over the projecting broach ends until they rest on table *C*, after which a lever is operated, which starts the machine through its cycle. The two broaches are automatically raised by hydraulic cylinders in the base, the upper ends of the broaches passing through the gears until the body size of the broaches becomes large enough to lift the gears from the table. As the broaches and gears continue to rise, the broach ends pass through holes in the faceplate of the machine and enter openings in the pull-head. At this point, the pull-head is locked to the ends of the broaches and the lifting cylinders in the base are automatically released from the tail end of the broaches.

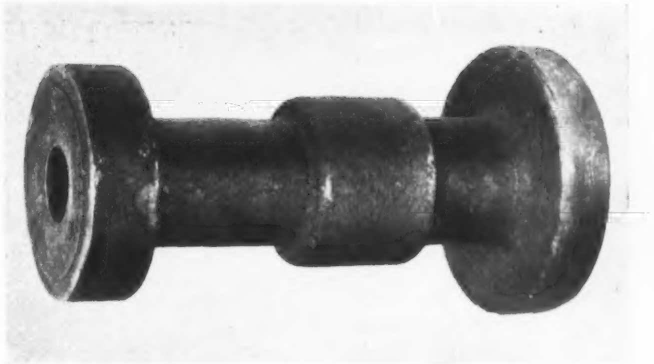


Fig. 3. Transmission Countergear in which a Hole 7 1/2 Inches Long is Broached by Using Three Broaches in Succession on One Machine

The pull-head then starts on its upward travel, the gears stopping against the faceplates, as seen at *A* and *B* and the broaches being pulled through them. When the lower ends of the broaches pass through the gears, the gears fall downward on table *C* and slide forward into a pocket in the front of the machine. Upon the completion of the upward machine stroke, the pull-head automatically returns to its starting position and unlocks from the upper ends of the broaches. The cylinders in the base then carry the broaches back to their starting positions.

On this operation, a production rate of 197 gears an hour is maintained, hydraulic pressure of 30 tons being applied to the ram for the operation, which is performed at the rate of 30 feet a minute. Chips are produced in such large quantities that it was advisable to provide a means of disposing of them automatically. This was done by so designing the machine that all chips are carried by the flood of lubricant into the floor pit, from which they are removed by a conveyor and discharged into tote boxes. A heavy lubricant (Stuart's cutting compound) is used in this operation.

Holes 7 1/2 inches long are broached to a diameter of from 0.989 to 0.990 inch in transmission countergears of the type seen in Fig. 3, from a rough-punched diameter of approximately 7/8 inch. The rough forgings are slipped into the six-station indexing fixture seen in the heading illustration on page 297, and are indexed automatically beneath three broaches for roughing, semi-finishing, and finishing cuts. This machine, which was built by the Lapointe Machine Tool Co., is designed to pull the broaches downward through the work.

After the broaches have been pulled through the gears, they are automatically disconnected from the overhead slide and permitted to drop clear of the gear blanks. Then the table indexes an amount equal to one-half the space between the fixture chucks and the broaches are raised between the work stations and again automatically connected to the overhead slide. This slide now moves upward so as to lift the broaches clear of the fixture, after which the fixture is again indexed to bring new gear blanks into line with the broaches. The overhead slide finally descends to connect the broaches with the ram, and the latter pulls them through the gears. This cycle is repeated about 130 times an hour.

Broaching Permits High-Speed Machining of Holes to Square Corners

An important advantage of broaching is that it permits the high-speed machining of holes to

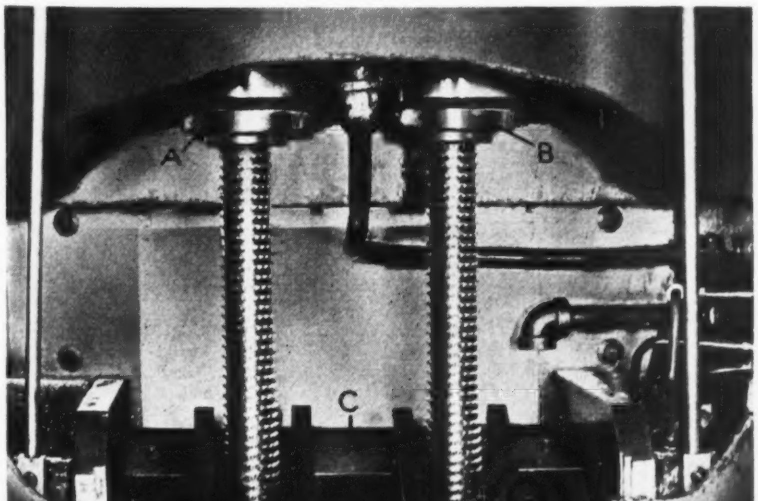


Fig. 4. The Helical Splines are Broached Simultaneously in Two Gear Blanks, which are Held against Overhead Faceplates during the Operation

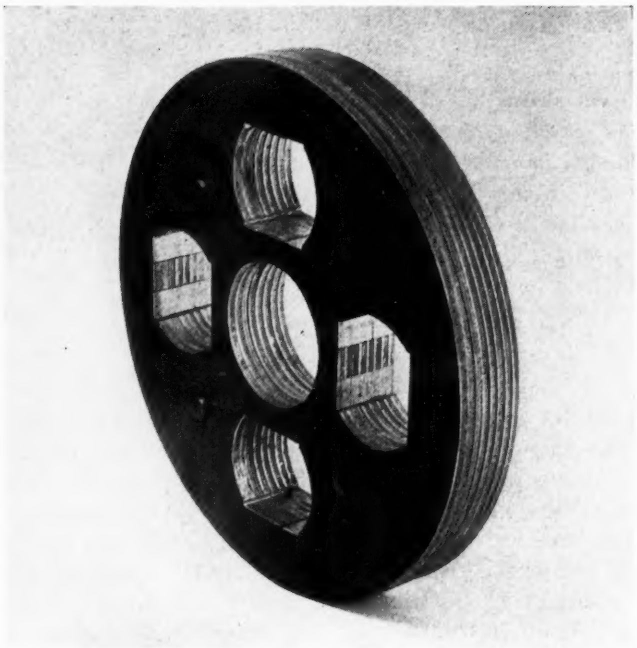


Fig. 5. Harmonic Balancer of Laminated Steel Disks Having Four Holes in which the Corners are Broached Square within Close Limits

square corners. The four holes in the laminated harmonic balancer shown in Fig. 5, for example, are finished at one time to a width that is held within 0.002 inch. Only the corners of the holes are important, and therefore, four shallow grooves about 1/4 inch wide are broached in each hole. The production rate is approximately 170 parts an hour.

This operation is performed on both Oilgear and Colonial machines of the vertical type with the piece laid in a simple fixture, as illustrated in Fig. 6. The broaches are pulled downward through the fixture and are guided accurately in grooves that engage narrow slots on both sides of each broach. At the end of each operation, the broaches are drawn up through the work before the machine is reloaded. These harmonic balancers are made up of either six or eight steel disks, depending upon the car model for which they are intended. In this operation "soda water" is a satisfactory lubricant.

Another example of square-hole broaching is illustrated in Fig. 7, which shows a Colonial machine used in an operation on clutch-cover stampings. Three holes, 1 9/16 inches long, must be broached to a width of from 0.840 to 0.842 inch in close relation to each other. The clutch cover is located and securely clamped along the rim by six air-operated jaws. The diameter of the rim is approximately 13 inches.

This operation is of the push-broach type. As the broach descends, it is accurately guided both

Fig. 6. Four Broaches with Teeth on Two Sides Simultaneously Broach the Square Holes of the Harmonic Balancer Shown in Fig. 5

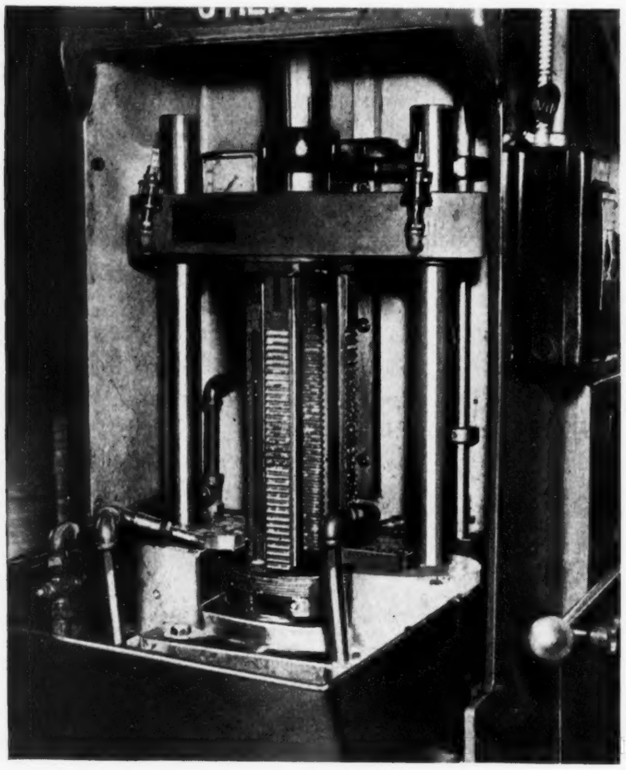
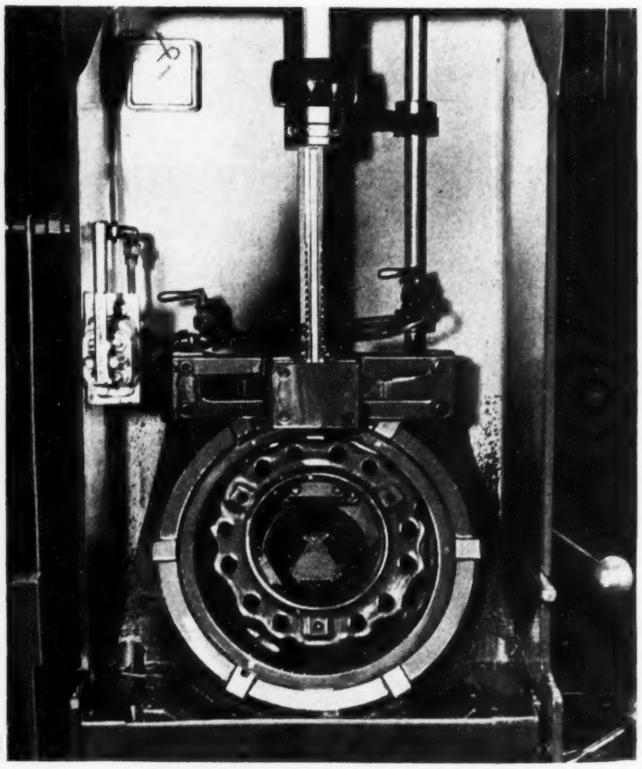


Fig. 7. Three Square Holes are Accurately Finished in Clutch-cover Stampings by a Single Broach and a Hand-indexed Fixture



above and below the work by means of tongues on the front and back sides of the broach, which engage grooves in rigidly supported blocks on the outside and inside of the work. With each upward movement of the broach, the fixture is indexed 120 degrees by hand to bring the next partially formed slot into line for broaching to the specified width. These stampings are 0.155 inch thick. They are broached at the rate of 87 an hour.

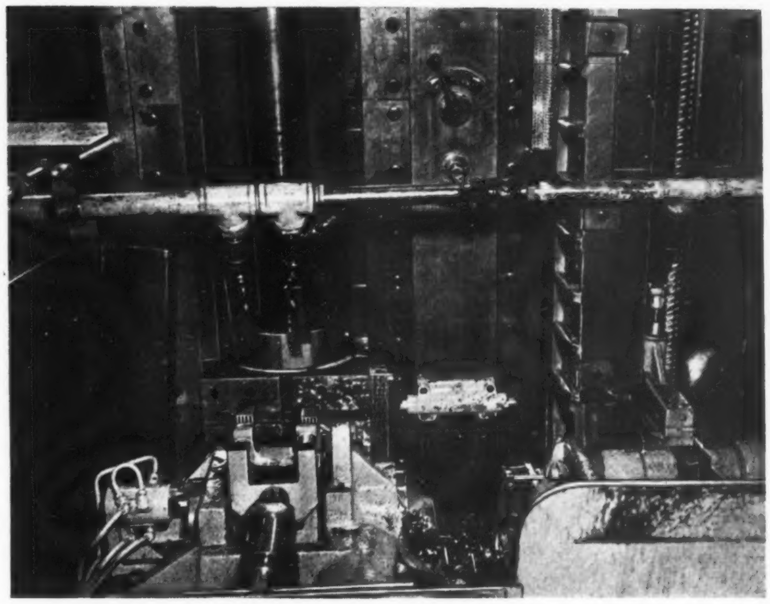


Fig. 8. A Double-ram Broaching Machine Equipped with Hydraulically Indexed Work Fixtures Performs the First Two Operations on the Steering Knuckles at the Rate of 120 Parts an Hour

Nineteen Surfaces Broached on Steering Knuckles

Five broaching machines have been installed for taking a total of nineteen cuts on steering knuckles. These parts are delivered to the first broaching machine in the rough state, seen in the background of Fig. 9, and are finished as seen in the foreground when they leave the last broaching operation. The first operation is performed on a huge double-ram machine built by the Colonial Broach Co., of which a close-up view is shown in Fig. 8. The rams operate alternately, so that when one ram is up, at the end of an operation, the other ram is down, ready to machine a piece in the second fixture.

Both fixtures are of the type that swing upward automatically through 90 degrees at the end of each upward ram stroke, so that they can be reloaded conveniently as the rams return to the starting position. After they have been reloaded, the fixtures are swung forward through 90 degrees by hydraulic means into line with the broaches for the operation. One of the fixtures slides forward horizontally a short distance toward the broaches after it has been indexed. In Fig. 8, the left-hand fixture is seen tilted upward in the loading position, while the right-hand fixture is shown in the forward or broaching position.

The broaches of the left-hand ram take cuts on the four inner and outer yoke surfaces *A*, Fig. 9, while the broaches of the right-hand ram take cuts on both sides *B* of the lugs and on edges *C* of the rib. Stock to a thickness of about 1/8 inch is broached from the various surfaces. The production of this machine is about 120 steering knuckles an hour.

The four ends *D* of the lugs are broached in one operation performed on an Oilgear machine equipped as illustrated in Fig. 10. This operation must be especially accurate, as the lugs are broached to provide surfaces for checking the caster angle at service stations. Each steering knuckle is located endwise in this machine by means of a stop-pin, and is clamped by pins that act against the shank when the handle at the right is tightened. The four broaches are accurately guided in slots in

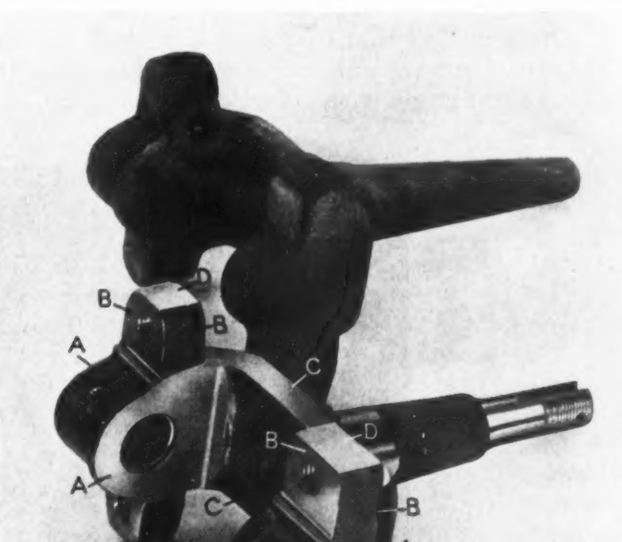


Fig. 9. Nineteen Surfaces are Finished on Buick Steering Knuckles by Broaching Operations Performed on Five Machines

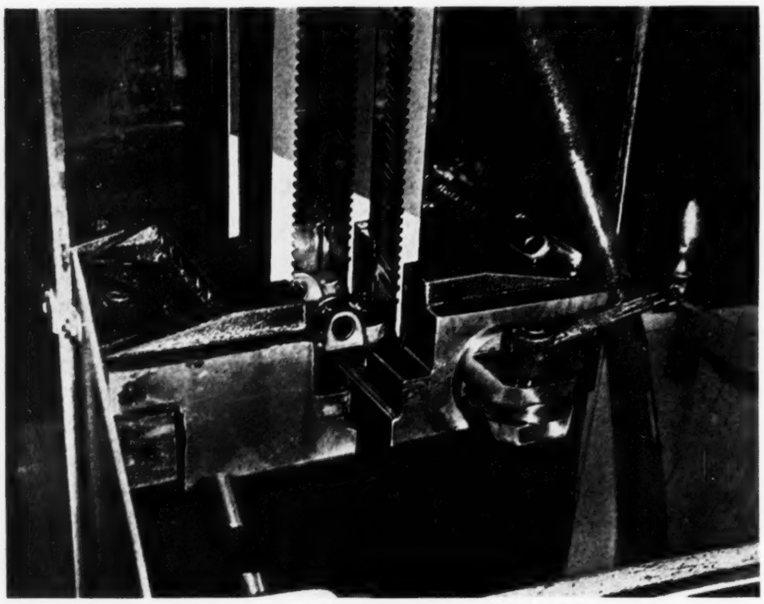


Fig. 10. Four Broaches which are Guided at the Machining Points by Means of Slots in the Fixture Remove Stock from the Ends of the Steering Knuckle Lugs

the fixture. When they are in the down position, the steering knuckle is lifted out of the fixture before the broaches are raised for the next operation. The average production is 200 steering knuckles an hour.

After a simple operation on an Oilgear vertical broaching machine that produces a finished shoulder on the underneath side of one yoke, the two yokes are finish-broached on the inside surfaces *A* on another Oilgear machine. When the steering knuckle reaches this machine, in addition to the broaching operations that have been described, the king-pin holes have been drilled and reamed. Bushings have also been pressed into these holes and burnished by pushing a broach through them.

In the finish-broaching operation on the inside of the yokes, the steering knuckles are located from the bushing holes by means of plungers. The shank is seated in a V-block. In this way, the yoke surfaces are finish-broached to a true right angle with the axis of the king-pin bushings. The production on this operation is at the rate of 240 an hour.

The hole in bevel ring gears is finish-broached from bored holes on the Lapointe horizontal machine illustrated in Fig. 11. A broach 9 inches long removes from 0.0045 to 0.007 inch of stock on a side to finish the hole to a diameter of from 5.609 to 5.610 inches. This broach is of a ring type.

At the beginning of the operation, the broach is mounted on an arbor *A* and the gear blank *B* to be broached is slipped on ram *C*, against the faceplate. The broach is then slid from arbor *A* to ram *C* and a C-washer *D* is entered into a groove in ram *C* to hold the broach to the ram. When the ram is pulled toward the left, the broach is drawn through the work. As the work slides off the broach, it is slipped off the ram by the operator. Washer *D* is then taken off to permit the broach to be returned to arbor *A* for reloading the next gear. The production is 300 gear blanks an hour.

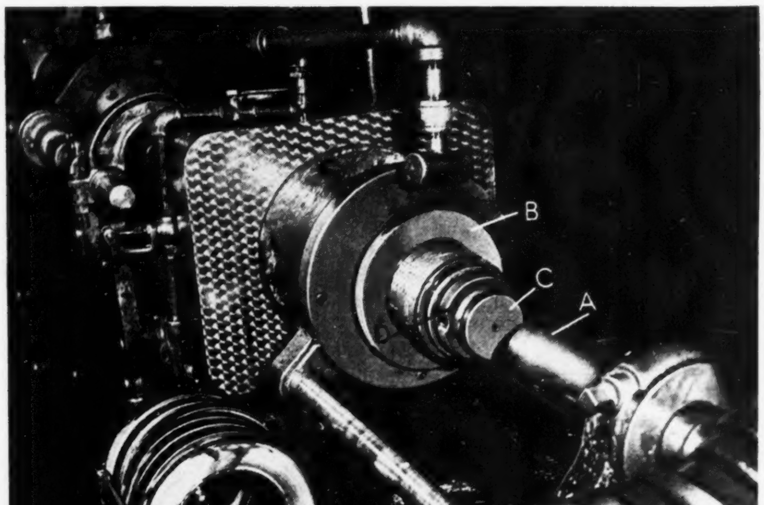


Fig. 11. The Hole in Bevel Ring Gears is Finished by Means of a Short Hollow Broach that is Slipped on and off the Machine Ram for Loading and Unloading the Work

Training Boys to Take Their Place in Industry

Most of the Unemployed are Unable to Take Care of Themselves Because They Have Never Acquired the Skill of a Trade. To Train Boys to Earn a Living and to Take Their Proper Place in Industry, Trade, or Agriculture Should be a Primary Objective of the Public Schools

By GEORGE E. McLAUGHLIN
Director of Vocational Education
Lancaster Public Schools, Lancaster, Pa.

Putting the Finishing Touches on a Metal Pattern. Robert Barton, a Student in the Cooperative Course of the Lancaster, Pa., Vocational High School, is Learning Patternmaking at the Lancaster Malleable Casting Co.

PUBLIC education and industry, in their present status, represent two separate and distinct activities in our national life. They serve very different puposes, and yet they have a great deal in common if we are to solve intelligently, on one hand, the problem of placing our youth in self-respecting occupations, giving them the incentive and ability to stand on their own feet and earn their own living, and, on the other, the increasing need of industry for skilled workmen in order to carry on efficiently the work of supplying useful goods and services to the people of the country.

The primary job of the system of public education should be to give such instruction as will enable boys and girls to take their places as useful members of the community. A cultural education is of little value to one who cannot earn his own living. In fact, it has a tendency simply to make him dissatisfied and to become a destructive rather than a constructive force in the social structure. Hence, public education should aim first to train youth to be useful; and second, to supplement that training with a cultural background.

It is on this basis that the vocational schools have been developed. One of the successful vocational school systems that has been instituted in cooperation with industry is that of Lancaster, Pa. Here schools and industries work together for a common purpose in developing skilled, self-respecting, capable young men, able to give useful work in return for the advantages of a civilized community.

In the Lancaster vocational education system, the first principle applied is that the boys should be trained when possible in a trade for which they show an inclination and fitness. The first demand on the school, therefore, is to determine the latent abilities and inclinations of the boy. Under the Lancaster system, the boys in the seventh, eighth, and ninth grades of the junior high school are given try-outs in several vocations.

In these try-out courses, each boy is given certain tests, first, with a view to determining his abstract mental ability—that is, ability to learn

from the printed page; and, second, to determine his mechanical intelligence. The latter test is supplemented with others to determine dexterity and other necessary qualifications. The teachers' ratings for the three years, together with the abovementioned test results, are used as guidance material when the time comes for each student to select a course that he wishes to take in the senior high school; and should he select a vocational course, he is materially assisted in selecting the trade in which he is most likely to succeed.

A Vocational School that Combines Training in Manual Skill and Cultural Subjects

Students selecting the vocational course are immediately placed in classes that spend two full weeks in a well equipped school shop and two weeks in academic studies. The students are not long in the school shop before they realize that one of the main objectives of the training is to establish a proper attitude toward work and life. The importance of this should not be under-estimated in establishing vocational courses. Many a good mechanic today is unable to understand that the reason he has not succeeded better in life is simply because he does not understand that manual skill is not the only requirement of a good workman. He must also know how to cooperate with others, to secure the best results for himself and for the organization with which he is connected.

Hence, at the completion of every job assigned to a student, he is graded by the instructor, in his presence, not only on the quality and quantity of the work done, but, in addition, on his dependability, industry, civility, initiative, appreciation of safe working methods, knowledge applied, judgment, and regularity in attendance. This method of grading is of great assistance in developing a type of boy most likely to succeed in life.

To further stimulate the interest and effort of the boys, a so-called Junior Industrial Conference was established. Some 100 boys are taken each summer to a camp adjoining the city where for one week they are the guests of the Manufacturers' Association of the city, all expenses being paid by the Association, except that the boys provide personal camping equipment, such as towels, etc.

The boys selected for the vocational conference are those who have displayed the best attitude toward their work and the greatest cooperation, those who have the best scholastic record, who have developed the greatest skill during the year, and who have been most regular in their attendance. The week at the camp is spent almost entirely outdoors in most favorable surroundings, and is properly directed to include a combination of play and work. There are two conferences each day conducted by industrial leaders of the community. During these conferences, such topics as ethics in industry, cooperation, the responsibility of an industrial worker to his job and his community, etc., are discussed.

In addition to the practical shop work, the student is required to take a broad course in social studies, English, plain geometry, trigonometry, physics, chemistry, and drawing.

Cooperative Industrial Courses Begin at the End of the Second Year

After the student has followed the courses laid out in the foregoing for two years, he begins on an additional one-year course on the cooperative industrial basis, in which he alternates each two weeks with a fellow student in working in an industrial plant, and spends the other two weeks in school. Before starting on this cooperative course, he signs an apprentice contract with the plant in which he is to be employed. In all, he must serve 4800 hours in the shop, but he is given credit for the time spent in the school shop.

It is during the period of alternation between industry and school that industry makes its largest contribution. No school can train a boy completely for industry, because it is impossible to transfer the industrial atmosphere into a school building, nor is it possible for a school to obtain many of the more expensive pieces of equipment; hence, for the final training, a boy should always be placed in an industrial plant.

At the end of the third year in school, the apprentice has not completed his 4800 hours of shop work, so he continues his apprenticeship in the shop, giving his full time to shop work. When he has completed his apprenticeship, he is not only a full-fledged mechanic, but is also a high school graduate with a substantial academic background.

Those who are anxious to solve our social problems pertaining to promoting the best interests of the youth of the country, and to provide a high-grade, well educated, skilled body of workers in industry have here a solution to their problem. Those who believe in the importance of trained workers, with a background of intelligent citizenship and a balanced attitude toward public questions, can promote these ideals in no better way than by working toward the establishment of vocational cooperative schools.

Unfortunately, in most communities, the public schools and the industrial establishments go about their business as if they had no interests in common. As a result, we have, on one hand, millions of young men incapable of earning a living, because they have been given no training, and on the other, industrialists complaining of the scarcity of skilled workers. If the public schools are to fill their place in the community, they must arouse the interest of the industrialists in a real cooperative vocational training which will benefit all concerned.

While such cooperative schools have been established in perhaps half a dozen communities throughout the United States, the rest of the country is still unaware of the great opportunities to utilize the latent talent found in America's youth and to develop that talent to the highest degree.

MACHINERY'S DATA SHEETS 337 and 338

MACHINERY'S DATA SHEET INDEX—I

February, 1934, to December, 1936, Inclusive

MACHINERY'S Data Sheet No. 337, New Series, January, 1937

MACHINERY'S DATA SHEET INDEX—II

February, 1934, to December, 1936, Inclusive

MACHINERY'S Data Sheet No. 338, New Series, January, 1937

$300 in Prizes for Articles on Ingenious Mechanisms

MACHINERY offers sixteen prizes for the sixteen best articles on ingenious mechanisms, each article to be confined to one mechanism or mechanical movement.

Two prizes—each, $50 Four prizes—each, $25 Ten prizes—each, $10	in addition to regular space rates

MACHINERY'S regular space rates will be paid not only for the prize-winning articles, but also for any articles accepted for publication that may not receive a prize.

Each contestant may send as many articles as he wishes. All will be entered in the competition and all may be accepted for publication; but no contestant will be awarded more than one prize.

Articles entered in this competition should be addressed to the Editor of MACHINERY, 148 Lafayette St., New York City. They must be mailed on or before March 15.

Preparing Articles for the Competition

This competition applies to any kind of mechanism making use of a practical and ingenious mechanical motion or principle. The competition is open to all, whether subscribers to MACHINERY or not. The general procedure is very simple.

1. Send a drawing of the mechanism (or photograph, if preferred—or both) that clearly shows all important parts of the particular movement to be described.
2. Describe as clearly as possible both the *purpose* of the mechanism and its *action—how* it does *what* it does.
3. Mark the important parts on the drawing, such as levers, cams, etc., with letters, *A*, *B*, etc., and use corresponding letters to identify those parts in the description; thus: "Lever *A* is operated by cam *B*." This will help to make the description readily understood.
4. Confine each article to a single mechanism or movement, and do not describe an entire machine or refer to parts that do not affect the movement being described.

Suggestions about Illustrations and Manuscripts

Clear blueprints or pencil drawings with distinct lines are satisfactory. They should be made on separate sheets of paper. Send only drawings that are "to scale," with the various parts shown in correct relationship and proportion. Rough free-hand sketches cannot be used. The drawing must show the assembled mechanism, although a diagram, or a drawing that is partly diagrammatic, may often be substituted to advantage, especially if it more clearly illustrates the arrangement of a complicated mechanism.

It is more essential that important facts be clearly stated than that the manuscript be neatly written; but carefully prepared manuscripts usually indicate careful thought.

Avoid describing a mechanism that is familiar to most designers; descriptions of movements that are generally known cannot be accepted, even though they may be very ingenious. It is immaterial how long ago a mechanism or movement was originally designed, provided it has not previously been described in any publication or text-book.

Important Suggestions

Be sure to describe as clearly as possible both the purpose of the mechanism and its action — what it does and how it does it. Describe the purpose first, and the means of accomplishing it afterward.

Confine each article to a description of a single mechanism or mechanical movement. Do not attempt to describe the entire machine of which the mechanism or movement is a part. Clear descriptions of separate mechanisms, rather than descriptions of entire machines are desired. Omit, as far as possible, reference to parts of the machine that do not affect the movement being described.

Do not describe mechanisms that are familiar to most designers. On the other hand, it is immaterial how long ago a mechanism or movement was designed; but it must not have previously been described in any publication or text-book.

Electrically Deposited Cutting Edges Reduce Tool Costs

A Recently Developed Electrode is Used to Produce New Metal-Cutting Tools at Low Cost and to Restore Worn Edges of Old Tools

By E. W. P. SMITH, Consulting Engineer
Lincoln Electric Co., Cleveland, Ohio

AN arc-welding electrode known as "Toolweld," which can be deposited on a softer metal, such as cold-rolled steel, to give it a cutting edge equal to that of high-speed steel, and with which the worn edges of metal-cutting tools can be built up for regrinding to the original size, has been developed by the Lincoln Electric Co., Cleveland, Ohio. This weld material has a hardness of 55 to 65 Rockwell C as deposited without heat-treatment. The hardness varies within this range according to the admixture of the weld metal with the metal to which it is applied.

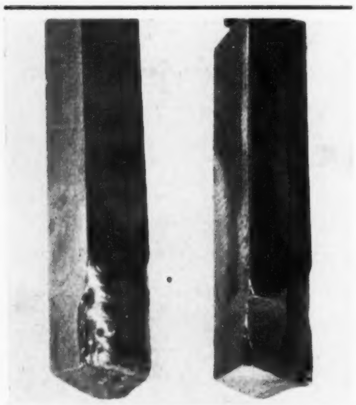
The deposited metal retains its hardness up to 1000 degrees F. It can be heat-treated the same as high-speed steel, and will meet the usual requirements of high-speed steel. While the electrode material deposited may cost from $3 to $5 a pound, the amount used, as compared with the amount of metal in the complete tool, is so small that a tool made of ordinary steel with cutting edges of the deposited metal will cost less than a solid tool of high-speed steel having the same cutting capacity.

The accompanying table shows the percentages of weld or electrode metal costing from $3 to $5 a pound that can be applied to a steel costing 5 cents a pound without exceeding the cost of single-metal tools made from cutting material costing from 40 cents to $1.40 a pound. Referring to the table, it will be noted that a tool made of the lowest price cutting material (40 cents a pound) costs as much as a tool which consists of 7 per cent deposited metal costing $5 a pound. This, however, is an extreme case. Now, if a tool made of a cutting material costing $1.40 a pound is compared with a tool made by depositing a weld material costing $3 a pound, it will be noted that 45.7

Table Showing Maximum Percentage of Deposited Electrode Metal which can be Used without Exceeding Cost of a Single-Metal Tool*

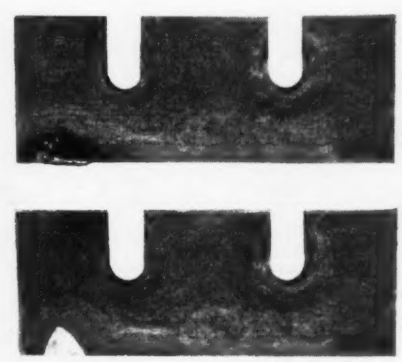
Cost per Pound of Material for Single-metal Tool	Cost per Pound of Deposited Electrode				
	$3.00	$3.50	$4.00	$4.50	$5.00
	Amount of Deposited Metal Used, Percentage of Total Weight of Tool				
$0.40	11.8	10.1	8.8	7.9	7.1
0.60	18.6	15.9	13.9	12.3	11.2
0.80	25.4	21.6	19.0	16.8	15.2
1.00	32.1	27.4	24.0	21.3	19.2
1.20	38.9	33.2	29.1	25.8	23.2
1.40	45.7	39.0	34.1	30.3	27.4

*Based on depositing electrode metal on material costing 5 cents a pound.



(Left) Tool with Worn Cutting Edge Built up by Deposit of "Toolweld," before and after being Ground

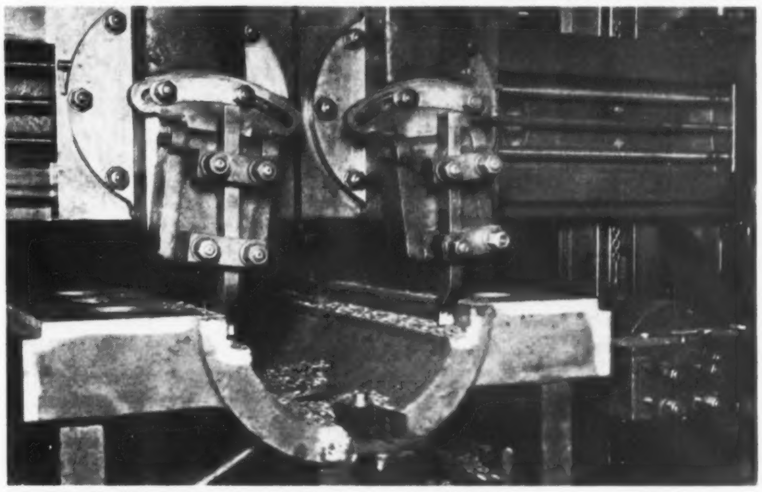
(Right) Built-up Blade of Coping Die Shear Having a Nick about 1/8 Inch Deep and 1 Inch Long, before and after Regrinding. This Repair Job Took Only One-half Hour



Turning Down Motor-generator Shaft in a Lathe Equipped with a Tool Made from Cold-rolled Steel with a Deposit of "Toolweld" Electrode

Cutting a Hard Grade A Meehanite Casting in a Vertical Turret Lathe with Tools Having Cutting Edges of "Toolweld" Electrode. The Tools were Made by the Wellman Engineering Co., Cleveland, Ohio, Using Lincoln Equipment

A Planer Tool of "Toolweld" Electrode is Used Successfully with a High-speed Steel Tool Costing Several Times as Much as the "Toolweld" Tool



per cent of the tool can be deposited material. As it rarely happens that the amount of weld material runs as high as 10 per cent, the saving in most cases resulting from the use of the electrode or weld material is considerable.

Of course, the single-metal tool is ground away at each resharpening operation, whereas a tool made by depositing the electrode material has its cutting edge replaced by welding and grinding, thus retaining its original dimensions.

The accompanying illustrations show examples of some tools that have been built up with "Toolweld." The heading illustration shows a lathe tool, of ordinary alloy steel, faced with "Toolweld" electrode, being used for cutting cast steel. The captions indicate the uses of the other tools.

Selecting and Handling Tool Steel in a Large Plant

By FRANCIS S. WALTERS, Tool Engineer
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

SEVERAL years ago, the Westinghouse Electric & Mfg. Co. used thirty different grades of steel for tools and dies. Gradually this number was reduced to nineteen. Then a committee was appointed to make a study of the tool-steel problem and to select and specify the kinds of steel to be used for different purposes. This study resulted in fourteen steels being specified. It is expected that this may be shortly reduced to twelve grades, which will adequately take care of the requirements for tools and dies in the plant.

The committee classified and tabulated the applications of the various steels, giving the correct applications for the various grades and the proper heat-treatments. The complete data gathered is a valuable guidance for tool designers and toolmakers.

A detailed procedure was standardized relating to the purchasing, marking, inspection, etc., of tool steels. The marking is of particular interest. From the time the steel is received until the tool or die is completed, it is definitely identified so that both the supplier and the grade of the steel in a tool are known at all times. This method of marking is of particular importance for the heat-treating department. It also identifies the supplier in case of either poor or exceptionally good performance. This marking system also eliminates long explanations on drawings.

The supplier of the tool steel is requested to mark all bars with a number and a letter. The number indicates the grade of the steel and the letter indicates the supplier. Bars less than 3 feet long are stamped on each end, but bars longer than 3 feet are stamped on each end and also in the center of the bar. For example, high-carbon chromium steel is known as No. 15 steel throughout the works. When steel of this grade is purchased from a steel company, the bars, as well as the finished tools, are all marked "15-D." The figure "15" stands for the grade of the steel, and "D" for the supplier.

When a specific tool is to be made from this steel, the heat-treatment is determined upon, and a figure added to identify this heat-treatment. The tool would then be marked "15-D-1," for example, the "1" signifying the heat-treatment to which it is to be subjected. It will be readily seen that at any time the steel in any tool or die can be identified, the supplier is known, and the heat-treatment to which it has been subjected is recorded right in the marking.

By reducing the grades of steel carried in stock, a very substantial saving in inventory is accomplished. This saving amounts to about 30 per cent; yet the fourteen standard grades meet 95 per cent of all the requirements within the plant. Obviously there are some cases where it is justifiable to puchase a small amount of a particular brand or type of steel to meet specific requirements. However, such purchases ought to be considered as special and such steel would not be kept regularly in stock.

The many new types and grades of steel that have come on the market in recent years are rather confusing, but the man responsible for tooling equipment must continually investigate such new types as show promise of reducing production costs. This justifies the old method of cut and try, which is the only method that can definitely answer the question as to the value of new steels. Experience has taught that actual performance tests are worth a whole world of promises.

Standard data sheets are provided which indicate the kind of steel that should be used for different types of tools, consideration being also given to the number of parts to be machined. For example, if stampings are to be made in a die and the required number is small, a different type of steel would be used than if the die is required for a very large number of stampings. Other data sheets are provided listing the different types of steel and then indicating the heat-treatment, method of machining, the results expected, and the applications. Where necessary, sketches are also shown on these data sheets to make the instructions perfectly clear.

For example, these instructions would be as follows: *Type of steel:* No. 15, high-carbon, high-chromium steel; heat-treatment, 15-1. *Machining information:* Rough-machine, strain-relieve, finish-machine, and harden. *Hardness:* Rockwell, 60 to 63. *Results wanted:* Hard and tough tools with minimum distortion and highly wear-resisting. *Application:* Dies that it is impracticable to grind, for hard, scaly, ferrous materials of all thicknesses and non-ferrous materials of all thicknesses. Used for dies by which from 5000 to 50,000 punchings are to be made; also used for thread-rolling dies. Incidentally, eight different heat-treatments are

specified for the No. 15 steel, according to the purposes for which it is to be used.

A system of marking tool steels and specifying heat-treatments, applications, and other information mentioned, is well worth while in any plant using a large amount of tool steel. It is a great help to the designers and draftsmen as well as to the toolmaking and heat-treating departments. Each company, of course, must work out its problem in accordance with its own requirements, but the suggestions above may prove helpful in devising a system for marking and recording tool steel that will prove economical and convenient in many other plants.

Threading Taps Must be Suited to the Work to be Done

There is No Such Thing as One Style of Tap Being Suitable for All Tapping Operations or for Any Kind of Material

By H. GOLDBERG, Vice-President
R. G. Haskins Co., Chicago, Ill.

DURING recent years there have been many improvements in the design and manufacture of taps, but unfortunately there is very little data available as to the kind of work for which different styles of taps are best suited. We have, for example, carbon steel taps with two, three, or four flutes, and high-speed steel taps made to the same design. These taps have cut threads. Then we have high-speed steel taps with ground threads, and in this group we have the "commercial" ground and the "precision" ground taps with different tolerances. Furthermore, the chamfers differ, and we have taper, plug, and bottoming taps; more recently we have added the "shear cut" or "gun" tap.

The tap manufacturer who will first add to his catalogue a section on the purposes for which each of these different grades and classes of taps is most suitable will perform a real service to the industry. At present, most users of taps merely specify the size and pitch, and trust to the tapmaker to send the correct tap. As a result, in a great many cases, wrong taps are supplied when more suitable ones are available, and trouble is likely to be met with when tapping.

Tap manufacturers, of necessity, must make taps to meet average conditions, and their general line of taps must be capable of tapping holes in any kind of material, in every type of machine, and under varying shop conditions. It is obvious, however, that these general-purpose taps will not remove metal in the most economical manner under all of these conditions. For certain requirements, a three-fluted tap would be the most efficient. For another job, a two- or four-fluted tap might be the best.

Industry is demanding better threads and closer tolerances. High-speed tapping can be done only with taps especially designed for the material and conditions for which they are intended. Such special taps cost more than standard ones, but when production is high enough, they are more economical, because the cost per tapped hole will be much less. If the tap user will give the tap manufacturer, who has made a careful study of the needs of different kinds of tapping, full information as to what he wants to tap, he is reasonably sure to obtain a tap suited to his needs. Such special taps may be longer or shorter than standard, or may have a different style of flute and width of land. The amount of hook and the chamfer may differ, and there may even be a variation in the pitch diameter to produce a hole of the same size as would be expected from a standard type tap. The type of machine on which the taps are used also influences the design of the tap. All of this information must be given to the tap manufacturer.

It is not the writer's intention to encourage the use of special taps when standard ones will serve the purpose. For most of the ordinary tapping jobs, standard taps can be used, but even standard taps are made in several styles, and it is important that the right style be selected for the job. Sometimes a slight modification in the width of land, the amount of hook, or the chamfer will overcome tapping difficulties, even when standard taps are used. The tap manufacturer can give instructions for a simple grinding operation that may be performed by the user himself and that will greatly improve the efficiency of the tap.

* * *

The amount of nickel consumed in the world in 1935—80,000 tons—reached an all-time record for that metal. No other important metal exceeded in consumption the pre-depression figures.

Grinding Tapered Seats in Rotary Valves

Fig. 1. Bodies of Rotary Valves which are Ground to a Taper on the Lands that Extend Around the Port Openings

ROTARY valves are made by one prominent manufacturer with a tapered plug that is revolved and simultaneously advanced axially to close tightly on land surfaces extending around the ports. The plug is revolved in the opposite direction to open the valve. Bodies for valves of this type are shown in Fig. 1.

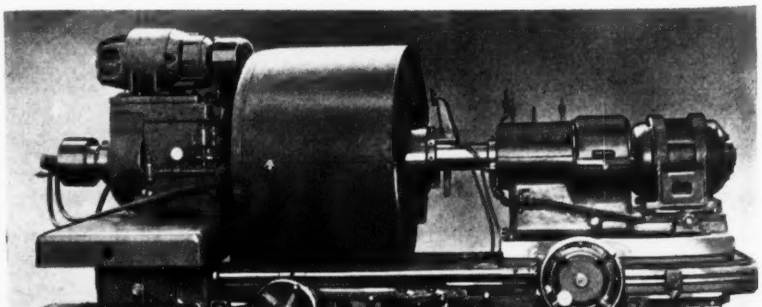
It is essential that the land surfaces surrounding the ports of these valves be finished accurately, in order to permit tight closing of the tapered plug. This accuracy is obtained by grinding the lands on the Heald No. 77 internal grinding machine illustrated in Fig. 2, which is fitted with a special work-head. The lands around both ports are ground in the same operation. A final lapping operation is performed after the grinding.

Since the lands must be ground to various amounts of taper up to 10 degrees included angle, depending upon the size of the valve bodies, the work-head is so arranged that it can be swiveled and locked in the desired setting. It can be positioned at any angle up to 22 1/2 degrees included angle. The machine is therefore adapted to a wide range of work in addition to the valve bodies.

Valve bodies with ports from 2 to 8 inches in diameter can be accommodated by this equipment, the largest valve body weighing approximately 600 pounds. Because of the heavy weight that the work-head is required to carry, it is mounted on a large-diameter spindle which runs in heavy-duty Timken bearings, thus insuring easy rotation. The guard that surrounds the work completely during an operation is opened and closed by hydraulic means.

The fixture consists of a U-shaped casting that is well ribbed to provide rigidity. It is bolted to the flange of the work-head spindle. The valve body to be ground is located from a counterbore in one of its faces, which is seated on a hardened and ground adapter plate. It is attached to this adapter

Fig. 2. Heald Internal Grinding Machine Arranged with a Swiveling Work-head that Permits Grinding Valve Bodies of Various Sizes to the Required Taper



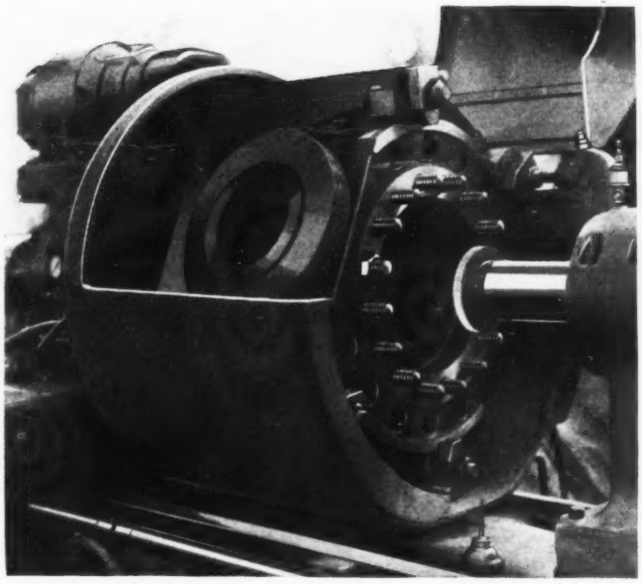


Fig. 3. Large Valve Bodies are Bolted to an Adapter Plate for the Taper Grinding Operation, and this Plate is Accurately Located on and Clamped to Work Fixture

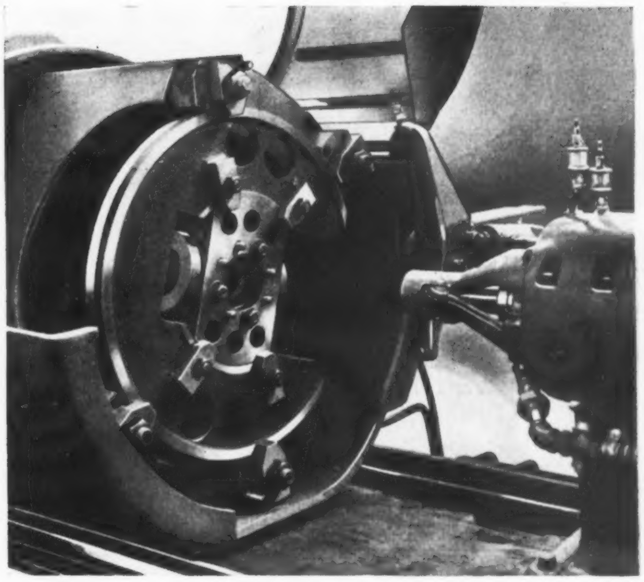


Fig. 4. Small Valve Bodies Require a Sub-adapter Plate which is Attached to an Auxiliary Plate that is Accurately Located on and Clamped to the Work Fixture

by tightening nuts on studs that project from the face of the valve, as will be apparent from Fig. 3. The adapter plate and the valve are then clamped as one unit to the fixture, being located from the ground periphery of the adapter plate. The small sizes of valve bodies are bolted to a sub-adapter plate, as seen in Fig. 4, which is then attached to an auxiliary plate that is clamped to the fixture.

Rigidity of the large valves during the grinding operation is insured by a pneumatically operated pusher-rod, which supports the valve body from the back. Three different wheel-heads are required for grinding the seven sizes of valve bodies.

The lapping operation that follows this taper grinding operation now requires only a few minutes, whereas with the previous method of grinding the port lands, hours were generally consumed in lapping.

The Advance of the Diesel Engine

IN connection with the Exposition of Power and Mechanical Engineering held in New York in December, the memory of Rudolf Diesel and the fortieth anniversary of the introduction of Diesel power in the United States were commemorated at a luncheon organized by the Diesel Committee of the Exposition, at which were present the leaders in the Diesel engine manufacturing field in the United States and many other prominent engineers.

The rapid advance of Diesel power in this country is best indicated by quoting some of the figures that were presented. In 1915, nineteen years after the introduction of the Diesel engine in America, the sale of Diesel engines in this country amounted to less than 100,000 horsepower a year. Previous to the business depression, the peak figure was 452,000 horsepower. Beginning with 1934, however, there was a very rapid advance, the horsepower produced in that year being double that of 1933. In 1935 there was a total of 1,200,000 Diesel horsepower produced, and in 1936 the figure reached 2,100,000 horsepower.

The chief reason for this tremendous growth in output is the adaptation of the Diesel engine to transportation. While the streamline Diesel train has claimed the limelight, the actual horsepower of Diesel engines in railroad service is relatively small. It is the truck and tractor fields that are responsible for much of the increase. In fact, the tractor has absorbed one-half of the Diesel output during the past year.

The Diesel engine of the past was a slow-speed heavy machine. The engine of today operates at speeds of from 600 to 1200 revolutions per minute and weighs from 100 down to 10 pounds per horsepower, with a few engines actually below even this minimum. They are available in units ranging from a few horsepower up to 20,000 horsepower.

Engineering News Flashes

The World Over

Smallest Ball Bearing in the World

Frequently we have referred to the largest developments in various branches of engineering. An example of the opposite extreme recently came to our attention, when we had the opportunity to inspect what doubtless is the smallest ball bearing in the world. This tiny ball bearing was developed by the engineering department of the Split Ballbearing Corporation of Lebanon, N. H., a company that devotes itself largely to the manufacture of special bearings for difficult applications.

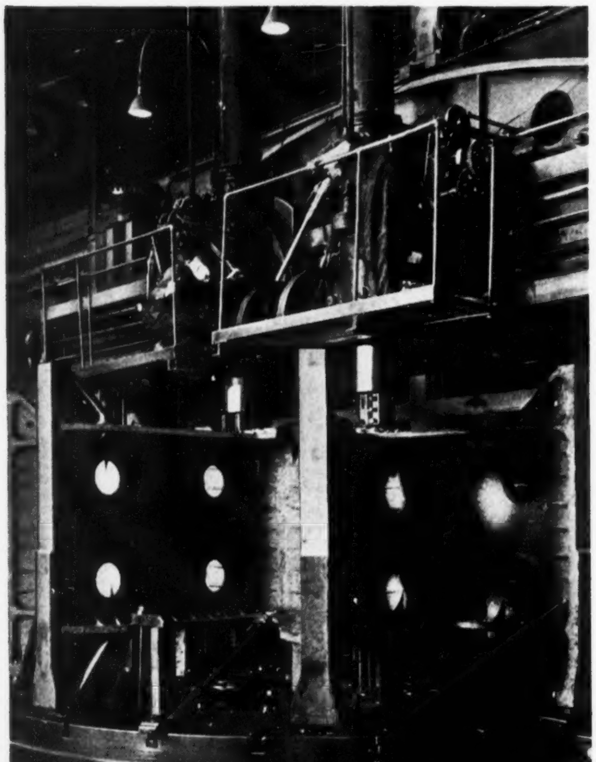
At the request of another manufacturer, the corporation recently undertook the investigation of equipment suitable for the manufacture of miniature-sized ball bearings, for which there is an increasing demand in fine precision instruments. The problem was made more difficult by the fact that the extreme accuracy required had to be achieved entirely through machining processes, as it was impossible to grind such exceedingly small parts as were encountered in this bearing. The work was accomplished largely through the use of novel electrical and magnetic controls.

The completed bearing is almost exactly 1/16 inch outside diameter and 1/32 inch in width—actually smaller than the head of a common pin. The bore is 0.023 inch. The balls in this midget bearing were furnished by the Norma-Hoffmann Bearings Corporation, Stamford, Conn., and are also examples of unusual precision. They are only 1/64 inch in diameter and have the accuracy of high-grade measuring gage-blocks. The mechanical work on the bearing was done by the consulting engineer of the Split Ballbearing Corporation, Winslow S. Pierce, Jr., who is the originator of the fracturing process used by the company in the manufacture of their regular ball bearings of the divisible race type.

The miniature bearing is now installed in a Waltham watch as a substitute for the jewel at the end of the second-hand shaft. It is actually so much smaller than the jewel it replaced that it was necessary to make a bushing to go around the outer race.

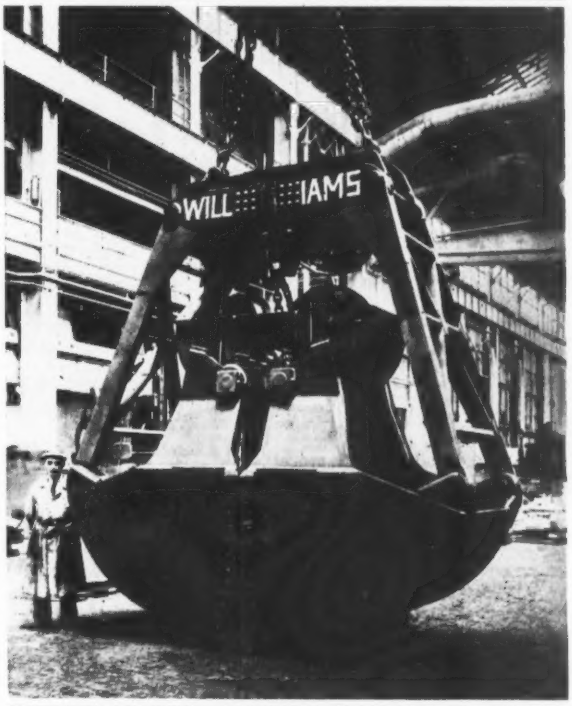
Fireproof Cotton Duck

An important industrial problem has been solved through the development of a new fire-resistant cotton duck which will not ignite, even when exposed directly to fire. The new fabric is a product of the William E. Hooper & Sons Co., Philadelphia and Baltimore. More than ten years have been spent in research to develop a fire-resistant finish for this purpose. The treated fabric, as well as the finish itself, is known by the trade name "Fire Chief." It has the advantage of also being resistant to the action of water and weather conditions, as well as resistant to mildew. Both the finished fabric and the compound used for the finishing are avail-



The machining of the spider for one of the world's largest hydro-electric generators in the East Pittsburgh shops of the Westinghouse Electric & Mfg. Co. required machine tools not only of large capacity but capable of precision work. This electric equipment will generate electricity at Boulder Dam. The steel casting weighs 7000 pounds and is about 18 feet in diameter by 8 feet high.

A coal bucket constructed by the Wellman Engineering Co., Cleveland, Ohio, which is capable of handling 7 tons of coal at a time, fabricated entirely of a nickel-copper alloy steel, Yoloy, made by the Youngstown Sheet & Tube Co. The bucket has jaws with a 16-foot reach that grab 7 tons of coal at one bite. The bucket weighs 18,000 pounds.



able to the trade. The material is already being used for awnings, welding curtains, machinery and merchandise covers, and in bus and trailer construction, as well as in the marine and pleasure boat fields.

World's Largest Oil Tank

What is claimed to be the world's largest pressure oil tank was recently completed at Port Arthur, Tex. This steel tank has a capacity of 100,000 barrels of oil. It is 141 1/2 feet in diameter and 40 feet high from the ground to the top liquid level. The tank is made in the shape of a Hortonspheroid and is subjected to an internal pressure of ten pounds per square inch.

New Development in Out-of-Step Relay

A new relay to prevent continued operation of synchronous machines out of synchronism with their connected system, or to function to separate large interconnected systems at a specific location, in the event of an out-of-step or unstable condition between the sources of power on both sides of this location, has been developed by the General Electric Co. The out-of-step relay consists of an instantaneous over-current unit, a single-phase power-directional unit, an auxiliary unit to increase the operating speed, a notching device, and a time-delay element for resetting the notching device. All these are mounted in a standard 5 1/2- by 16-inch case. A capacitor and resistor for the notching unit are mounted externally. The device operates on an over-current and power-directional principle.

A New Motorcycle Engine

From England comes the news of a new small internal-combustion engine for which remarkable performance is claimed. According to *Industrial Britain*, a young British engineer has developed a 2 1/2-horsepower engine which, applied to a motorcycle, has driven the latter at a speed of 100 miles an hour in test runs. The maximum speed of the engine is 14,000 revolutions per minute. Traveling at a speed up to 80 miles an hour, the motorcycle covered 150 miles to the gallon of gasoline. It is added that a cheap grade of gasoline was used.

The principle of the new engine, which is not disclosed in the news item received, is also applicable to larger internal-combustion engines, and the inventor is said to be engaged at present in developing a four-cylinder airplane engine for the use of a well-known British firm of airplane manufacturers.

Rubber Mountings Solve Vibration Problem

A serious vibration problem presented itself to the Indiana Ox Fibre Brush Co. of Seymour, Ind. Located on the third floor of the company's plant is a double blower weighing approximately 1000 pounds, driven with a belt between the two fans. The power is supplied by a 15-horsepower motor at 1800 revolutions per minute, driving the fans at 1250 revolutions per minute. The blower is mounted on a raised platform. The vibration resulting not only affected the building structure immediately surrounding the machine, but also affected the floor above so much as to impair the use of a considerable space.

The problem was solved satisfactorily by mounting the blower on a series of 3-inch long Vibro-Insulators made by the B. F. Goodrich Co., Akron, Ohio. These vibration dampers are so designed that the machine base can be attached directly to the top of the insulators. Each insulator will support a load of 150 pounds; hence eight of these insulators were installed at various points under the frame to support the entire load of 1000 pounds. As a result, the vibration has been dampened to the point where it is no longer causing any trouble. The remedy was applied at small expense.

EDITORIAL COMMENT

Early Revision of the Undistributed Profits Tax is Needed

According to reliable information from Washington, it seems reasonably certain that Congress, when it convenes, will revise the undistributed profits tax law with the view of eliminating some of its most objectionable features. While hardly any taxes under our chaotic system of taxation are based upon the rational conception that taxes should be levied in proportion to the benefits received by those taxed, instead of on the power of the Government to tax and the ability of the individual or corporation to pay, no tax is more harmful in its effects than the undistributed profits tax. Here we have a levy that clearly discourages industrial expansion and enterprise, thereby limiting the opportunities for employment and the chance for labor to earn a living. Information to the effect that this tax law will be modified is, therefore, good news, not only to business but to labor as well.

One of the objectionable features of this tax is the fact that businesses that have tided over the depression by borrowing money to keep their organizations together and to provide as much employment as feasible are now being penalized for paying their debts; they are not permitted to use profits made during the current year for paying these debts unless they also pay a heavy tax to the Government, which, in some cases, may be as high as 27 per cent of the undistributed profits; or *more than one-third of the debt being paid off*. This is in addition to all other income and corporation taxes.

Industry and Labor Alike Lose by Confiscatory Taxes

Where a concern has obtained enough business during the past year to make an expansion in equipment desirable, the buying of new equipment is discouraged by the fact that if current profits are spent for new machinery, the same heavy tax must be paid as in the case of payment of debts. This means that firms that otherwise might have increased their plants and provided more employment feel constrained from so doing.

Manufacturers in the machinery field particularly, where heavy inventories must be carried over from one year to the next, are facing another serious difficulty. Firms that have made a profit during the present year have found it imperative to put these profits in castings and finished parts, to fill orders that will be delivered next year. The tax law takes no account of this, however, but demands that the undistributed profits tax be paid on the amounts so invested. All this obviously is a serious handicap to business and is holding back recovery.

A revision of some of the most objectionable features of this tax law will, therefore, be welcomed by employers and workers alike.

Don't Discard a New Process Because of the First Failure

Frequently many plants have failed to profit by the advantages to be obtained from newly developed tools, equipment, or methods, because in the first application of the new development some factors necessary to success have been overlooked and the tool or method has been discarded as being "no good."

Very often the failure to obtain satisfactory results the first time is due simply to lack of experience with a new tool or method. Take, for example, the new hard cutting alloys. Some years ago many shop executives and operators alike pronounced them useless in their work, because they tried to apply them exactly as they would a high-speed steel tool, when as a matter of fact, there are some distinct differences in the application of the two tool materials which make the difference between success and failure.

Similar experiences have been met with in the application of new welding methods. Because the first application of welding to a certain job did not prove satisfactory, the whole process was considered unsuitable for that class of work. As likely as not, the failure was due to overlooking some important point in welding design or to lack of skill on the part of the welding operator.

New developments should not be condemned because of failure in the first trial. If the results are not satisfactory at first, it is well to obtain additional information as to how the work ought to be carried out to be successful. Don't be too hasty in saying: "It can't be done." A competitor may have found that it *can* be done, to his own advantage.

How to Determine Clearance and Shearing Pressure in Designing Blanking Dies

By J. M. SCHMIED
Assistant Chief Development Engineer
Victor Mfg. & Gasket Co., Chicago, Ill.

ENGINEERS responsible for the design and manufacture of punches and dies for blanking ferrous and non-ferrous metals, sheets of molded plastics, and other materials frequently lack adequate information concerning factors that are essential to correct die design. For example, some designers assume the average shearing resistance for a die to be one-half the total calculated resistance, whereas others believe one-third of the total resistance to be more nearly correct.

Keen competition demands that dies be designed for operation under conditions of greatest economy, especially dies that must produce millions of parts. Such operations should be performed at the highest possible speed and in the smallest press that will operate the die efficiently, in order to reduce power consumption to a minimum. The high power consumption that results from the use of a press equipped with an unnecessarily heavy flywheel or ram sometimes makes it impossible to produce parts in the punch press within estimated costs.

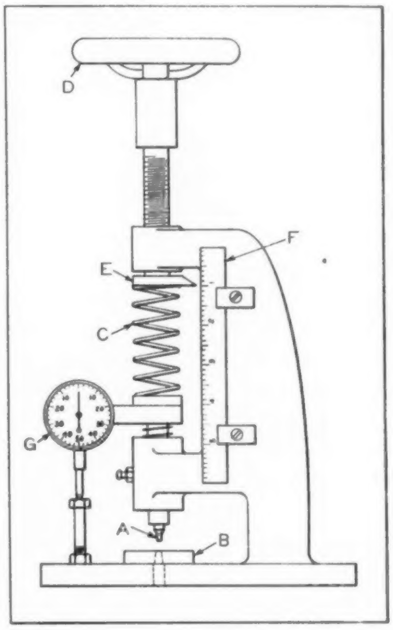


Fig. 1. Diagram of a Sub-press Used to Determine Clearance and Shearing Pressure in Designing a Blanking Die for Any Material

This article will explain a simple method of determining three important factors in designing a blanking die. They are (1) the proper clearance between the punch and die; (2) the total shearing pressure; and (3) the proper size of flywheel for a press of the required tonnage capacity.

Simple Means of Determining Proper Clearance between a Blanking Punch and Die

The proper amount of clearance that should be provided between a punch and die for blanking any material can be readily determined with the aid of an inexpensive sub-press, such as illustrated diagrammatically in Fig. 1. First a simple punch, 0.125 inch in diameter, and a corresponding die should be made for use in this press, as indicated at *A* and *B*. Then a helical spring of round wire should be selected for use in the press, as shown at *C*. This spring should be of sufficient strength to force the punch through the metal to be sheared when handwheel *D* is turned to compress the spring, without the spring being compressed solidly. The ends of the spring should be closed and ground square with the axis.

Experiments should be made in blanking the material with various degrees of clearance between the punch and die. Starting with a snug fit, the clearance should be increased by lapping the die until burrs commence to show around the pierced hole. Readings should be taken with each 0.0001 inch increase in the diameter of the die hole, of the amount of reduction in the length of spring *C* at the instant that blanking occurs. This can be conveniently done by noting the position of pointer *E* along scale *F*. The diameter of the die corresponding with the smallest amount of spring deflection during a blanking operation provides the proper amount of clearance for the material blanked.

In a similar manner, a determination can be made of the value derived from using a cutting compound for reducing the required shearing pressure. The shrinkage of holes in blanks and the expansion of blanks that occur with various amounts of clearance can also be ascertained by making measurements with micrometers. When experiments are being made on material that must be blanked at high temperatures, the punch and die should be made of tungsten carbide.

After the proper clearance for a die has been determined in the manner explained, an investigation should be made of the deflection that occurs in the spring with the application of various amounts of pressure, in order that the shearing

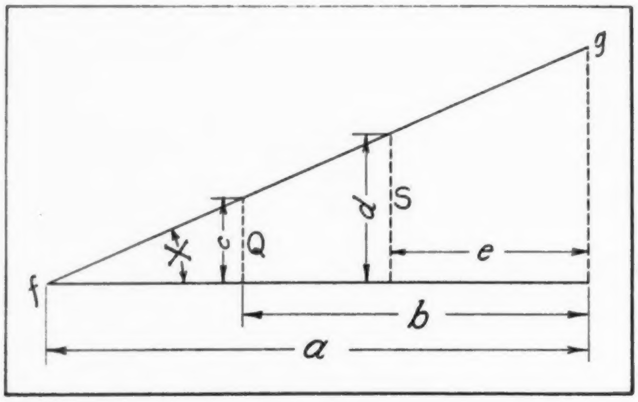


Fig. 2. Method of Determining Pressure Applied in Deflecting Spring C, Fig. 1, Any Specific Amount

pressure may be closely determined. In making this calibration, the spring should be removed from the press, placed upright, and a piece of steel or cast iron, picked at random, placed on top of the spring. A diagram such as illustrated in Fig. 2 should then be constructed by laying out a line of length a to represent the free length of the spring and marking off on this line a length b corresponding to the height of the spring when compressed by the weight Q that was selected. The diagram should be constructed at least four times actual size in order to insure that the readings will be sufficiently accurate.

A perpendicular is next erected to line b representing weight Q. The length c of this line should be determined by assuming each 1/64 inch to represent 1 pound of weight Q. Therefore, if weight Q amounts to 76 pounds, the line c would be 1 3/16 inches long. After length c has been determined, line fg may be projected through the end of line c, so as to obtain angle X.

From this diagram it will now be possible to determine the weight S that will cause the spring to deflect any specific amount e. This is ascertained by merely measuring the height of the perpendicular line d. This operation may be expressed mathematically as follows:

$$d = (a - e) \tan X$$

$$\text{Tan } X = \frac{d}{a - e}$$

To find the weight S required to deflect the spring to height e, simply multiply length d by 64.

In this manner is derived the most important factor (weight S) involved in determining the shearing pressure required for blanking various materials and the proper size of flywheel for the press used in actual production.

When the amount of clearance has been decided on for a punch and die, the pressure required for operating the die in a power press can be readily calculated, after first determining the pressure necessary for forcing test punch A, Fig. 1, through the material. The latter is determined by merely noting the position of pointer E relative to scale F at the instant that the punch cuts through the material. The corresponding value S, or the shearing pressure, in pounds, required for forcing the test punch through the material is then determined by means of the diagram Fig. 2.

The pressure required for operating the proposed blanking die can then be calculated by the formula:

$$T = \frac{LS}{0.125\pi \times 2000}$$

in which

T = total shearing pressure, in tons;
L = total length of die cutting edge, in inches;
0.125π = circumference of test punch cutting edge, in inches; and
S = shearing pressure, in pounds, required to force the test punch through the material.

Calculating the Proper Size of Flywheel for the Press

The proper size of flywheel to be used on a press of the required total capacity, as determined by the preceding formula, can also be readily determined by means of the sub-press. First, an investigation should be made of the amount that the test punch penetrates through the material for each 1/32 inch of spring deflection, and then the pressure, in pounds, that is exerted to compress

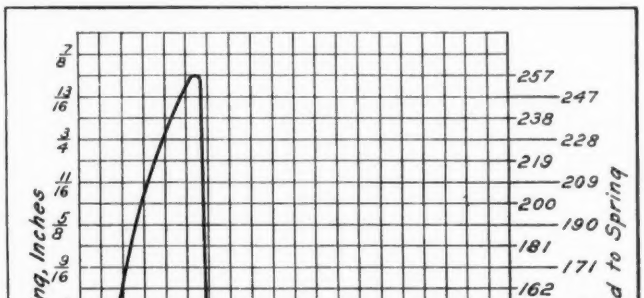


Fig. 3. Method of Determining Energy Required to Blank Any Material with a Test Punch and Die

the spring each additional 1/32 inch can be calculated in the manner already explained.

This investigation can be made by first allowing spring *C*, Fig. 1, to expand to its full height, with a piece of material beneath punch *A*, and then turning the bezel of indicator *G* to the zero graduation on the dial. Pressure is next applied on the spring and on the material to be punched by turning handwheel *D*. For each 1/32 inch compression of the spring, a reading should be taken on dial *G* of the amount of penetration of punch *A* through the material.

The readings taken in this manner should be plotted on a chart, such as shown in Fig. 3, in which each horizontal line is assumed to represent 1/32 inch of spring deflection, as indicated along the left-hand edge. On the right-hand side may be marked the pressure, in pounds, required for effecting each increase in spring deflection. Each of the vertical lines represents 0.0025 inch of punch penetration through the material, these lines being spaced the same distance apart as the horizontal lines.

After the amount of punch penetration, in thousandths of an inch, has been plotted on this diagram with respect to the corresponding spring deflection, a curve may be plotted, as shown, by drawing a line between the various points. The area bounded by this curve will be directly in proportion to the energy, in inch-pounds, required to blank the material with the test punch. Dividing the area by 12 will give the energy in foot-pounds. The area bounded by the curve can be determined by means of a planimeter or by making a careful estimate. In the example illustrated, the area is 2.924 square inches, and therefore the energy required for blanking the material with the test punch is 2.924 inch-pounds, or 0.2437 foot-pounds. The maximum pressure applied to spring *C* is 257 pounds.

Having determined factor *A* (area bounded by the curve), it is now possible to calculate the desired size of flywheel for operating the proposed blanking die any required number of times per minute. This may be done by means of a series of equations, in which

L_1 = shearing length of die, in feet ($L \div 12$);
u = circumference of test punch, in feet;
A = foot-pounds corresponding with curve area, Fig. 3;
E = total energy required in flywheel;
W = weight of flywheel, in pounds;
R = mean radius of flywheel rim, in feet;
v_1 = velocity of flywheel at mean radius, in feet per second, before any energy has been given out;
$v_2 = v_1$ — 10 per cent = velocity at mean radius of flywheel, in feet per second, at end of period in which the energy has been expended;
g = acceleration due to gravity = 32.16;
w = width of flywheel rim, in inches;
d = depth of flywheel rim, in inches;
n = revolutions per minute of flywheel;
f = efficiency factor of press (assumed to be 0.85);
$H.P.$ = horsepower; and
$K.W.$ = kilowatts per hour.

In these equations, the weight of cast iron per cubic inch will be taken to be 0.2604 pound. Then

$$E = \frac{L_1 A}{u}$$

But,

$$E = \frac{W\,(v_1^2 - v_2^2)}{2g}$$

Therefore,

$$\frac{L_1 A}{u} = \frac{W\,(v_1^2 - v_2^2)}{2g}$$

and

$$W = \frac{L_1 A 2g}{u\,(v_1^2 - v_2^2)}$$

Also,

$$W = wd \times 2\pi \times 12R \times 0.2604$$

Then

$$\frac{L_1 A 2g}{u\,(v_1^2 - v_2^2)} = wd \times 2\pi \times 12R \times 0.2604$$

Taking into account the efficiency factor f of the press,

$$wdR = \frac{L_1 A 2g}{u\,(v_1^2 - v_2^2) \times 24\pi \times 0.2604f}$$

After determining what the proportions of the flywheel should be for performing the job, the flywheel on the press that has been selected for the operation should be measured to find out how closely it approaches the ideal condition. The difference in horsepower required for operating the press with its actual flywheel and with the ideal flywheel, as determined by these calculations, can then be ascertained by means of the formula:

$$H.P. = \frac{En}{33000f}$$

The power consumption, in kilowatt-hours, can then be found by the formula:

$$K.W. = 60 \times H.P. \times 1.34$$

* * *

Collets for holding bar stock in either an automatic or a semi-automatic machine often wear out in a comparatively short time—sometimes fifteen hours or so. In order not to have to shut down the machine so frequently, several companies have found that if inserts of a wear-resistant alloy—Stellite, for example—are set into the steel collets, they can be expected to give at least one thousand hours of trouble-free service.

Giddings & Lewis Celebrates

IN 1862, Colonel DeGroat of Fond du Lac, Wis., built a small machine shop which was later to become the Giddings & Lewis Machine Tool Co. This concern, therefore, celebrates its seventy-fifth anniversary this year. The development of that business in the early days was closely connected with the history of the pioneer days of the Middle West.

Colonel DeGroat was a native of Belgium. In 1859, he started to build the first gray iron foundry in Wisconsin, although he did not begin to make castings until 1862. This foundry had a capacity for about fifty tons of castings a month. It was known as the DeGroat Foundry Co. During the Civil War, Colonel DeGroat obtained a number of contracts from the Government for war materials.

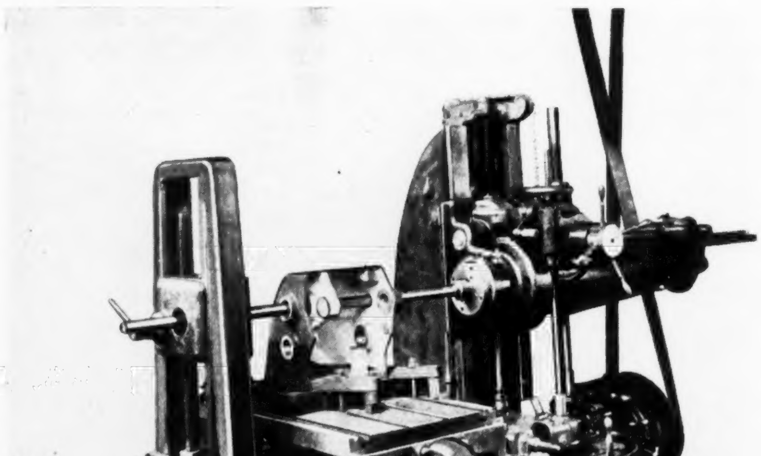
The Old Giddings & Lewis Plant as It Appeared about 1900

It was in 1862 that a machine shop was added. After the Civil War, this shop engaged in building saw mill machinery, which had been Colonel DeGroat's main object ever since he started the business, because the lumber industry was at its height in Wisconsin at that time. In fact, from about 1868 to 1880, Fond du Lac had eleven large saw mills in operation.

About 1872 the Wisconsin Central Railway was started from Sheboygan to Fond du Lac, with railway connections to Milwaukee. This caused a number of additional industries to be established in Fond du Lac having a demand for castings and other equipment, which the DeGroat company handled under jobbing contracts.

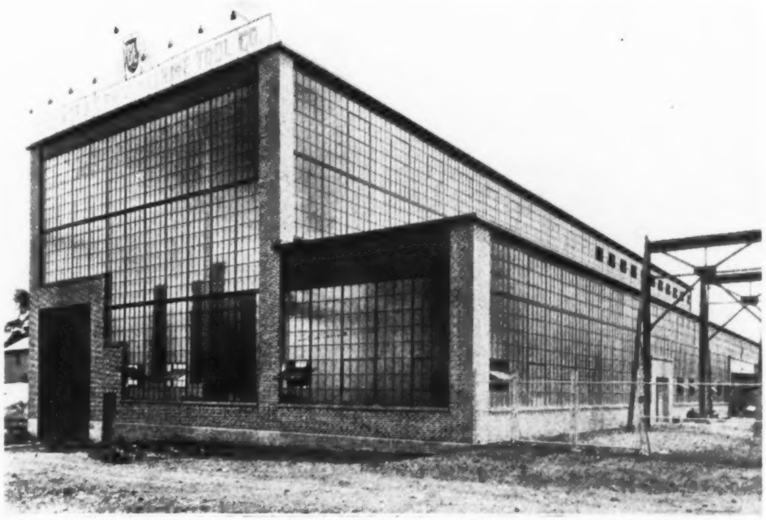
In 1878, Colonel DeGroat took his son-in-law Giddings into the business, and the company continued to make saw mill machinery until about 1902, at which time, after the death of Colonel DeGroat, Mr. Giddings took his son-in-law, Mr. Lewis, into the business, forming a corporation known as the Giddings & Lewis Mfg. Co. Shortly after this time, when the saw mills were gradually removed from this district, due to lack of timber, the company disposed of the saw mill machinery line to the Chalmers Co. of Milwaukee and the Murray Iron Works of Wausau, Wis.

It was at that time that the company turned to machine tools as its main product. The first machines built were 17- and 19-inch engine lathes. Some time about 1910 or 1911 the company made an arrangement with the Fawcus Gear Co. of Pittsburgh, Pa., and began to build Fawcus gear-cutting machines and other equipment in connection with the production of Wüst herringbone gears.



The Fosdick Horizontal Boring Machine which the Company Took Over in 1915 and of which a Great Many were Built During the Period of the World War

Seventy-Fifth Anniversary



The Latest Addition to the Giddings and Lewis Plant

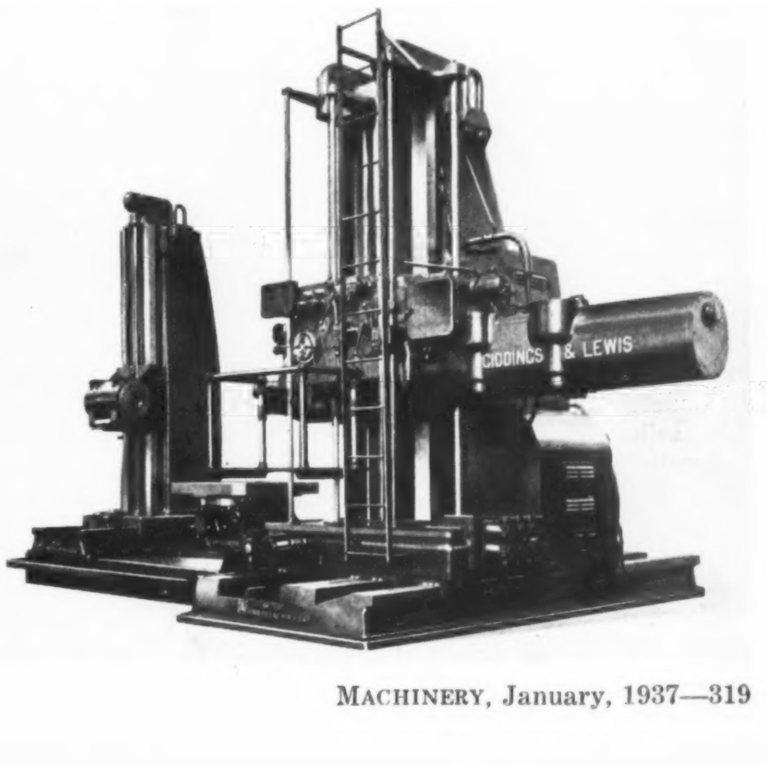
Ohio, which machines the Giddings & Lewis company continued to build until the end of the war.

In 1919, the company was reorganized under the present name—the Giddings & Lewis Machine Tool Co.—expanding its line of horizontal boring, drilling, and milling machines to 3-, 4-, and 5-inch sizes. In 1921, the company acquired the exclusive rights to an automatic internal grinder known as the Teromatic, of which a great many were built during the following six years, at the end of which period the company disposed of the grinder division to the Heald Machine Co., Worcester, Mass. About 1928 the entire line of horizontal boring, drilling, and milling machines, to which the company now gave its entire attention, was redesigned, including machines with main spindle diameters of from 3 to 8 inches, built in table, planer, floor, and multiple-head planer types, and ranging in weights from 20,000 pounds to 300,000 pounds per machine.

During the next three years the company expanded its manufacturing facilities by adding a large assembly building and a new power house, and by increasing the size of other parts of the plant to handle larger units. Even during the depression years the company did a reasonable amount of business, both domestic and foreign, and 1936 marked the biggest year's business in the entire history of the company.

About the same time the Rueping family, the principal owners of one of the largest tanneries in the country, located in Fond du Lac, acquired the controlling interest in the company and F. J. Rueping entered into a contract with C. M. Conradson to design a six-spindle automatic vertical turret lathe, of which fourteen of the largest sizes were built at the Giddings & Lewis plant in 1911 and 1912. During the same period, Mr. Conradson also designed what is believed to be the first hydraulically operated shaper, of which six were built, but these machines were never placed on the market.

The development work on the Conradson machines continued until 1914, when the World War began. At that time, Mr. Conradson left, and the Giddings & Lewis Mfg. Co. secured large contracts for shell lathes from the British Ministry of Munitions, which were completed in 1915. The company, now being without a specific machine tool line, acquired in the fall of 1915 the line of horizontal boring, drilling, and milling machines formerly built by the Fosdick Machine Tool Co. of Cincinnati,



One of the Horizontal Boring Machines Built by the Giddings & Lewis Machine Tool Co. Today, a Striking Contrast to the Boring Machine of Twenty Years Ago

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

S. & S.—In a speed reducer driven by a 3/4-H.P. motor, it is desired to reduce the speed in the ratio of 2 1/3 to 1. The drive should be smooth and noiseless. Two questions are raised in connection with this design: (1) Would it be advisable to do this by a chain drive? In that case, the available center distance could be arranged to be about 7 inches. (2) Would it be possible to do this by means of helical or herringbone gears with a center distance of 3 inches? If so, what would be the best helical angles and normal diametral pitch?

This question is submitted to MACHINERY's readers.

Selling Machinery "As Is"

D. P.—Frequently we sell used machinery under an "as is" clause in the sale contract. Does a clause of this kind in the contract render us clear of liability in the event the purchaser is not satisfied, or the machine is defective?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

Under ordinary circumstances, as when the salesman makes no statement regarding the quality of the machine, the purchaser is bound by the terms of an "as is" clause in a sale contract. However, if the salesman verbally states that the machine is in good condition, knowing that the machine is defective, this is fraud, for which the salesman's employer is liable.

For example, in the case of Ferguson v. Koch [268 Pac., 343], a buyer and seller signed a contract of sale which specified that the machine was sold "as is." Previous to the purchaser's affixing his signature to the contract, the salesman verbally guaranteed the machine. When the buyer discovered that the salesman's statement was false, he immediately sued to recover the purchase price. The seller attempted to avoid liability on the grounds that the buyer had ample opportunity to examine the machine, and also contended that testimony relating to the verbal statements was not admissible, particularly because the written contract contained an "as is" stipulation.

However, the Court held that the seller was bound to take the machine back and refund the purchaser's money. The Court said: "The general rule is well established that, where parties deal fairly or at arm's length, the rule of *caveat emptor*, applies; but, where honest dealing is departed from by the vendor making false statements as of his own knowledge, *the falsity of which is not known* to the purchaser, such purchaser has the undoubted right to rely implicity upon such statements, and the principle has no application. In other words, the vendor (seller) must stand mute, or at least refrain from making statements calculated to deceive... A purchaser has a right to rely on the presentations of his vendor as to facts not within his knowledge, and the seller cannot escape responsibility by showing that the purchaser might have ascertained upon inquiry that the representations were untrue."

In order that the reader may clearly understand the law involved in this case, it is well to explain that, the seller would *not* have been liable if the evidence had proved: (1) that the seller had made the false statement after the contract was signed; (2) that the seller actually did not know that the quality of the machine was not as stated in the written contract, but the seller merely expressed an opinion that he *believed* its quality to be as verbally represented; (3) or that the purchaser did not rely upon or believe the verbal statements made by the seller.

In other words, neither a seller nor his salesman may, without liability, make known false statements regarding the quality of merchandise, irrespective of the contents of a written contract. On the other hand, either a seller or his salesman may depend upon the purchaser's using his own good judgment to inspect a used machine and determine for himself when the quality of it meets with his requirements, if it is sold under an "as is" clause.

* * *

Among the advantages obtained by the use of die-cast chromium-plated grilles are greatly improved appearance and a material decrease in assembly costs. Of all types of alloys available, the zinc-base alloys for die-castings are by far the most widely applied in the automotive industry. This is due chiefly to the relatively low cost of these alloys, the ease with which they can be cast, and their good physical properties, as well as the ease with which they can be given various finishes.

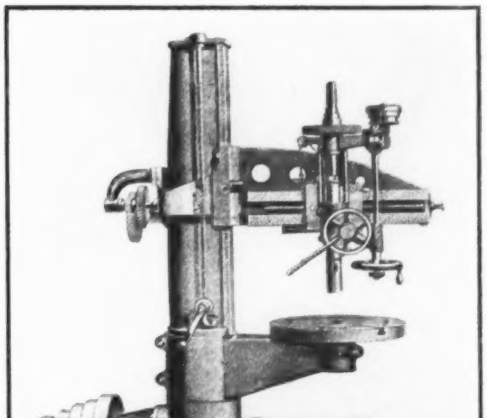
NEW TOOLS OF YESTERDAY

THE machine tool industry and the great industries that it serves are forward-looking. They look ahead to new methods, new developments, new achievements. They have little or no time to look backward. Still, there are occasions when it may be worth while to pause for a moment and catch a glimpse of the past—to note the great progress that has been made in machine design and construction in a comparatively brief span of time. Just as a new year is ushered in, such a backward glance may be especially appropriate.

For this reason MACHINERY'S pages, as they appeared forty years ago, have been scanned, and machines described at that time as new developments in the machine tool industry have been reproduced on this and following pages. These were the new machines and tools of that day. By way of contrast, compare them with the machines illustrated and described today in MACHINERY'S reading and advertising pages.

A 5-foot radial drill that was built by the Davis & Egan Machine Tool Co. of Cincinnati, Ohio, is shown in Fig. 1. The description of this machine, published in MACHINERY, July, 1896, mentioned that the column "is of the hollow box girder type and revolves in anti-friction bearings in the stump, to which it is closely fitted and which is firmly bolted to the base. The arm carrying the table also revolves about the outside of this same stump, and by a novel arrangement can be clamped to it without clamping the column, or they can all three be clamped

Fig. 1. A 5-foot Radial Drill Built in 1896 by the Davis & Egan Machine Tool Co., Cincinnati, Ohio



This Machine Had Anti-friction Bearings and a Clamping Arrangement Novel at that Time

rigidly together." A familiar expression, in describing this machine, is also found in the sentence: "The arm can be raised or lowered by the screw shown, which is convenient to the hand of the operator."

Fig. 2 shows a 21-inch upright drilling machine which is described as "one of the latest productions of Mr. J. E. Snyder, Worcester, Mass., whose drill presses are to be found in all parts of the country. It is quite a heavy machine, has back-gears, power feed, quick return, and automatic stop, and has a combined wheel and lever feed. . . . Back-gearing is controlled by a lever and very readily operated. . . . It is 98 inches in height and weighs 800 pounds."

In October, 1895, we find that "the demand for rapid lathe work, together with the increasing knowledge regarding the value of the turret lathe, has led to the adoption of the turret and sliding carriage on the regular engine lathe in place of the usual foot block or tailstock. The illustration [Fig. 3] shows the latest type of the 18-inch Springfield-Muller engine lathe with a turret added, made by the Springfield Machine Tool Co., of Springfield, Ohio. The tool is carefully designed to meet the requirements for heavy service and, though very solid and rigid, the convenience of the operator has been carefully looked after. . . . The combination of a turret with the usual engine lathe offers advantages possessed by no other arrangement, if its use was contemplated in the original design and not as an after consideration, so frequently the case. . . . A desirable feature allows the use of an endless belt, and so avoids all the annoyance due to lacing or hooks."

An "extra heavy" slab milling machine is described in May, 1896. It is mentioned that "the Ingersoll Milling Machine Co. of Rockford, Ill., are devoting their time exclusively to the type of machine illustrated [Fig. 4], this being the smallest size of the slab milling machine which they build. Their years of experience with this line of machines prove that the necessary requisites for a slab milling machine are a powerful drive, and then plenty of metal so placed as to resist strains of the powerful drive. . . . An idea of the rigidity and power of the machine can be imagined, when it is known that this machine will take a cut in cast iron 20 inches wide and 1/4 inch deep, at the rate of 5 inches per minute. This is not the maximum strength of the machine, but it is what it can be depended on to do in everyday work. We are also informed by the manufacturers that they are building various sizes of slab milling machines with horizontal or vertical spindles, or both, ranging in widths from 20 to 100 inches.

"There seems to be a tendency nowadays toward designing new work to accommodate the milling machine instead of the planer, and redesigning old work for the same purpose."

The boring mill shown in Fig. 5 was described in January, 1896. It shows "the improved boring and turning mill as recently gotten out by the Betts Machine Co., Wilmington, Del., U.S.A.

Fig. 2. A 21-inch Snyder Back-geared Upright Drilling Machine Announced in December, 1895. This Machine Had Power Feed, Quick Return and Automatic Stop

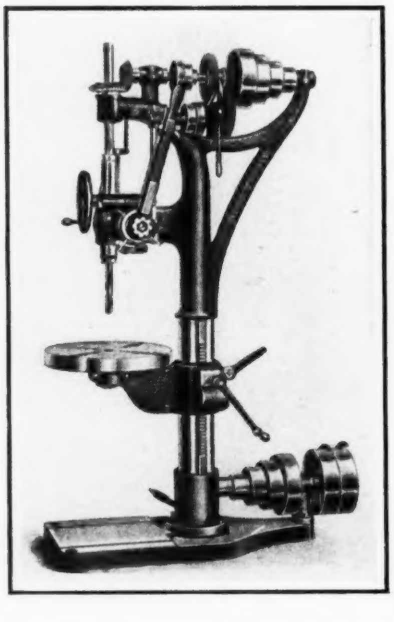
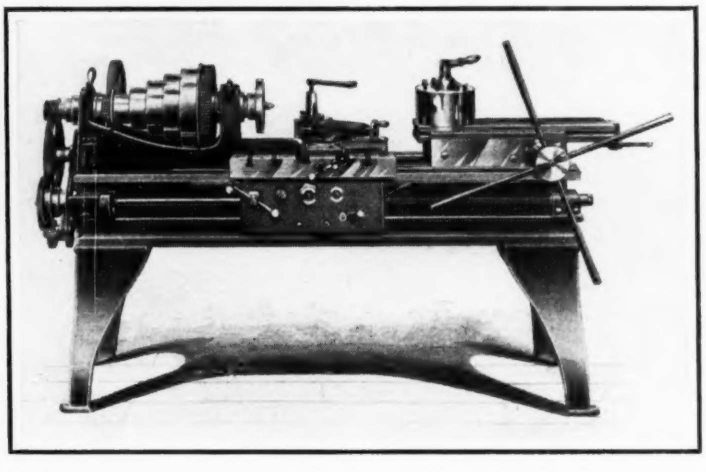


Fig. 3. An 18-inch Turret Engine Lathe Brought out by the Springfield Machine Tool Co. Just a Little More than Forty Years Ago. It was Especially Designed for Heavy Duty



The mill is stiff and heavy in all its parts and is conveniently and rapidly handled. It has the advantage of . . . positive and entirely independent feeds and of the perfect counterbalance to each spindle . . . The driving gears are all cut from the solid and all spur pinions are of forged steel. . . . Two complete sets of feeds are provided, making each saddle as independent of the other as though on separate machines. These feeds cover a wide range, are many in number, and have ample power."

The inserted-tooth milling cutters shown in Fig. 6 were illustrated and described in November, 1895, by Robert Grimshaw as follows: "While going through the shops of the Brown & Sharpe Mfg. Co., I saw a good many things which are not to be met with in the majority of machine shops in this country. Among them was a form of milling cutter with insertable teeth, the hub or center in which they were held being of cast iron arranged to be keyed to an arbor. [Then follows a detailed description of the cutters]. . . . The amount of projection of the teeth may be varied by packing pieces of paper, as, for instance, when after grinding they have become slightly shorter, or if it be desired to give every other one a trifle extra working depth.

"Cutters thus made have the advantages that they are much cheaper in first cost than solid cutters; that the form of the teeth may be altered at will, each cast-iron hub or center having, if desired, several sets of teeth of varying profile or width; and the destruction of any one of the teeth does not ruin the entire tool. The sharpening, also, may be done most efficiently with minimum trouble and calls for less skill and simpler appliances than the grinding of solid cutters."

The boring and turning mill shown in Fig. 7 is, according to MACHINERY, April, 1896, "one of the standard machines made by the Niles Tool Works of Hamilton, Ohio, and like most of their tools, is of very solid construction. It swings 121 1/2 inches in diameter, and when the cross-head is raised, will take a piece 54 inches high under the tool-holders. . . . The feeds are operated by friction disks and range from 1/32 to 9/16 inch. The tables have an annular bearing under the outer edge, and when heavy work is being done, the step is relieved and the table rests lightly on this outer bearing. The mill shown is made in sizes up to 16 feet."

In September, 1895, MACHINERY appeared a description of the machine shown in Fig. 8—a machine that was destined to become the forerunner of the world's best known bevel-gear cutting machines. It was stated that "this is the first published illustration of an automatic bevel-gear planer, on which foreign and American patents were issued to the Gleason Tool Co., Rochester, N. Y., in April, 1894. The gear to be planed is mounted on a spindle carried in the head of the machine, and the machine is moved back or forward like the tailstock of a lathe till the bevel gear it carries is in such a position that the apex of its cone-lines is at the center of the machine.

"The slide on which the tool-holder travels is rotated at the center of the machine, so that it can be moved in line with the pitch line angle

Fig. 5. A Betts Boring Mill (January, 1896) Having Positive and Entirely Independent Feeds for Each of the Two Spindles

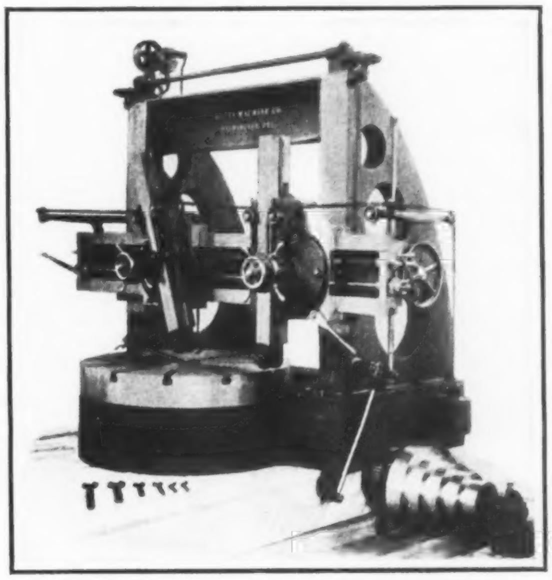
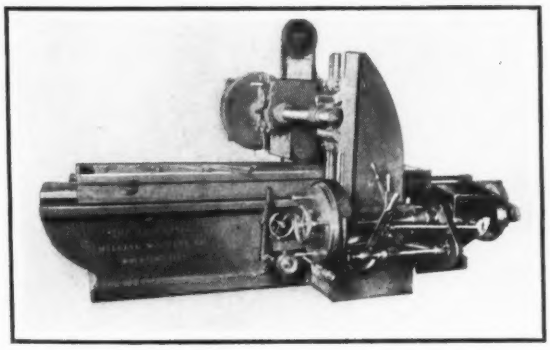


Fig. 4. A 20-inch by 7-foot Ingersoll Slab Milling Machine Illustrated and Described in MACHINERY, May, 1896. This was a Comparatively New Type of Machine Tool at That Time



of gear. Besides this horizontal adjustment of the slide, it is hinged at the center of the machine, so as to permit a vertical adjustment as it is fed over the former, so that the tool always travels on the correct angle of the gear from the top of tooth to the root, and the tooth therefore has the perfect reducing cut, and the small end is in proportion to the large end.

"The formers which give curve to the teeth are made very accurately. The master formers have been laid out with great care on a pitch circle several times larger than any gear to be planed, so that any possible inaccuracy in the former is reduced to a minimum in the gear. The formers which are furnished with the planers are made on a profile machine, so that they are exact duplicates of these master formers.

"For indexing, the first stop is adjusted so as to throw the feed out automatically when the tool has fed to the proper depth. The gear is indexed automatically and the second stop throws the feed in again.

"The machine is very simple of adjustment, and it requires no more skill to operate it than for an automatic rotary gear-cutter."

The machines illustrated give a comprehensive idea of the state of the art of machine tool design about forty years ago.

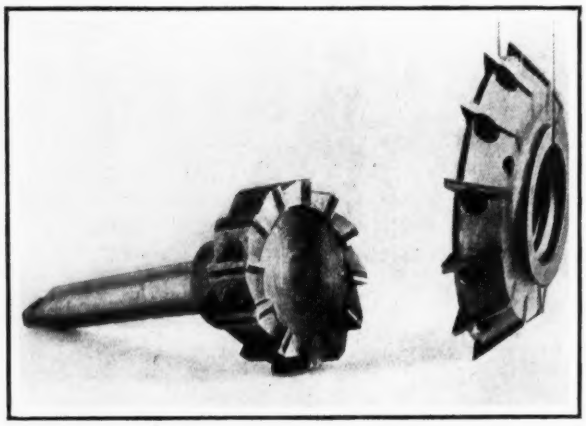


Fig. 6. Early Design of Brown & Sharpe Inserted-tooth Milling Cutters, Illustrated and Described in November, 1895

Fig. 7. A 10-foot Boring and Turning Mill Built by the Niles Tool Works in 1896. This Machine was Made in Different Sizes up to 16 Feet

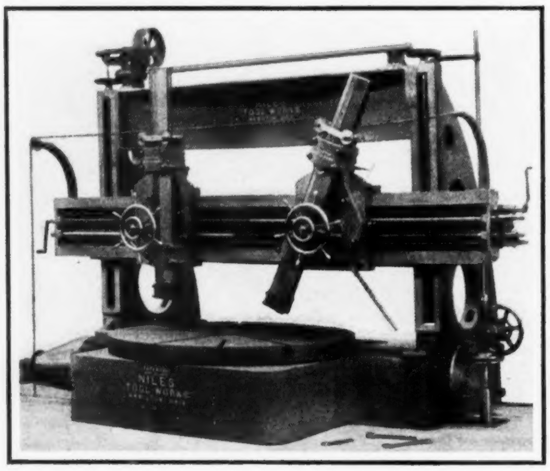
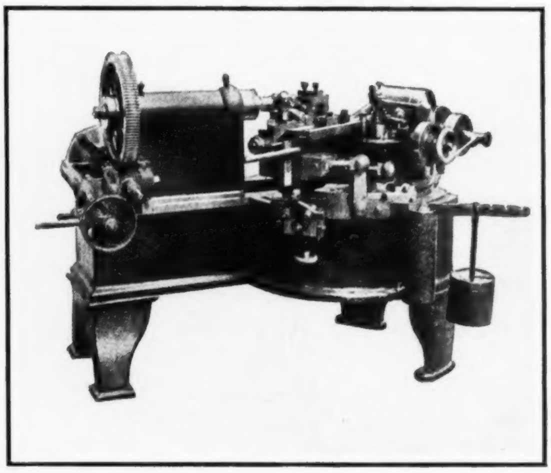


Fig. 8. The First Published Illustration (September, 1895) of the Gleason Automatic Bevel-gear Planer Patented in April, 1894



Increase in Production Capacity of Machine Tools in Ten Years

A Few Examples of the Increased Output and the Greater Accuracy Made Possible by Machine Tool Developments in the Last Ten Years—Additional Information on This Subject is Solicited for Publication in Coming Numbers of MACHINERY

THE advance in machine tool design during the last ten years has been so rapid—in some cases so revolutionary—that a comparison of the productive capacity of the machine tools available today with those available ten years ago should prove of considerable interest to every user of machine tools. Probably no industry has taken advantage of this increased capacity of modern machine tools to a greater extent than the automobile industry, and for that reason, many of the examples are from that field. But there have been such radical improvements in machine tools of all classes that it is not only the mass production industries that benefit from the advantages of the new machines. Results of equal value to machine tool users have been obtained in industries manufacturing on a smaller scale.

Among the reasons for this increased productive capacity of modern machine tools may be mentioned greater power and rigidity, greater speed range, longer tool life due to heavier support for the cutting tools, and improved lubrication. In addition, on new machines there is obviously less "down time" for machine repairs.

Remarkable Results in Crankpin and Camshaft Grinding

In October, 1926, figures were recorded on the finish-grinding of six-cylinder engine crankshafts having crankpins 2 by 1 3/8 inches, with a maximum of 0.030 inch of stock left by the rough-grinding operation for finish grinding. The production of a Norton double-head crankpin grinding machine was 51 crankshafts in a nine-hour day—about 5.7 crankshafts, or 34 pins, per hour.

Comparable figures for a Norton hydraulic crankpin grinding machine were recorded in October, 1934, covering the grinding of a similar crankshaft having pins 2 by 1 1/4 inches, with 0.050 inch of stock left from the turning operation. In this case, 12 shafts, or 72 pins, were finish-ground per hour.

In 1926, practically all automotive cams were ground in specially arranged plain cylindrical grinding machines. Figures collected in August, 1926, show that on a Norton machine, in grinding a camshaft for a six-cylinder engine, the production with one operator and one machine was 8 1/3 shafts, or 100 cams, per hour. A maximum of 0.025 inch of stock was removed from the diameter of the cylindrical portion of the cam in two operations without removing the shaft from the machine between operations.

Figures recently recorded in a large automobile plant for a Norton Cam-O-Matic show a production of 390 cams per hour. The stock removed is approximately 0.030 inch. The grinding is done in two operations, using two machines run by the same operator. This is nearly four times the number of cams per hour per operator, or nearly twice the production per machine, that was possible with the equipment available ten years ago.

Doubling the Output in a Slot Grinding Operation

In 1928, a Norton 10- by 18-inch grinding machine with a live spindle headstock and collet was used for grinding a slot in a transmission gear, removing 0.005 inch from the diameter and 0.005 inch from each side of a slot in a heat-treated gear, the slot being 1/4 inch wide. The production was at the rate of 150 pieces an hour.

Only five years later, in 1933, a Norton machine of the same capacity was arranged for grinding this identical gear slot with a live spindle headstock and draw-in collet, both of which were hydraulically operated. The production with this equipment was 300 pieces an hour under the same conditions as formerly prevailed.

Other Outstanding Production Increases in Camshaft Grinding

Ten years ago, according to the Landis Tool Co., it was considered very satisfactory production if a cam contour grinder ground one cam per minute, with one operator tending one machine. Today, on Landis hydraulic cam grinders, roughing eight-cylinder engine camshafts, 16 shafts, or 256 cams, are rough-ground per hour per machine, with one

man operating four machines. This is equivalent to 1024 cams per hour per operator, as compared with 60 previously. On the finishing operation on the same shaft, 11 shafts, or 176 cams, are ground per hour per machine, with one man running three machines, or 528 cams per hour per man.

Increased Grinding Performance of from 50 to 100 Per Cent Not Unusual

After checking customers' production records, the Heald Machine Co. has found that production has been stepped up from 50 to 75 per cent on practically all machines built by the company in the last ten years. In addition, the finish is better, and tolerances have been greatly reduced. If industry were satisfied with the tolerances and finish of ten years ago, the production on practically every job could easily be doubled. The same results have been recorded by the Bryant Chucking Grinder Co., where closer tolerances and better finish have been accompanied by from 50 to 100 per cent increase in production.

A remarkable example of increased capacity coupled with improved accuracy is furnished by the Van Norman Oscillator. This machine produces three times as much per hour as older machines, with tolerances not exceeding 0.0008 inch, as compared with 0.0015 inch on older machines. Coupled with the closer tolerances is a better finish. To accomplish this, the weight of the machine has been increased 1200 pounds. It is completely motorized, all movable parts are mounted in ball bearings, and the machine is fully automatic.

The Advance in Automatic Screw Machines

A manufacturer of electric household appliances requires 8195 hours for the manufacture of a certain line of parts on a row of old National Acme machines. These parts, when manufactured on a new National Acme 7/8-inch four-spindle machine, are produced in 2094 hours.

On larger parts made in the same plant, the old machines in use require 9820 hours, whereas the new 1 5/8-inch National Acme four-spindle machines take only 2792 hours.

In a large plant manufacturing automotive parts, the old machines required 8726 hours, whereas the same parts are now made on a 3 5/16-inch National Acme four-spindle machine in 4182 hours.

Some of these savings may be stated in dollars and cents instead of in time. A typical instance is found in a plant manufacturing trucks, where a saving of $3811 annually has been made possible on a 2-inch Gridley-Acme automatic machine of the four-spindle type. The total cost of the machine and tooling is $10,011; hence, there is a return of about 38 per cent on the investment. Among the reasons for these results may be mentioned faster indexing, greater speed range, and longer tool life due to better support of the cutting tools.

The greater productivity due to greater speed range is well exemplified in the Brown & Sharpe No. 00 automatic screw machines. In 1926, these machines had twelve changes of spindle speeds, ranging from 420 to 2400 revolutions per minute. Today, they have thirty-six speeds, ranging from 200 to 6000 revolutions per minute.

An interesting example is furnished by a Cleveland automatic machine. A valve connection 2 1/8 inches long over all, completely machined, is made from 1 3/8-inch hexagon brass bar. Six operations are performed to complete the work. On a seven-year old machine, the production was 112 pieces per hour, or 32 seconds per piece. On a new Cleveland machine of the same chucking capacity, built in 1936, the piece is produced at the rate of 172 per hour, or 21 seconds per piece, making an increase in production of about 34 per cent.

Some Significant Turret Lathe Comparisons

An interesting report has been obtained from a large Connecticut manufacturing plant relating to five Libby International turret lathes recently installed. Here machining time has been reduced by the use of the new machines as follows: On two large steel blanks of 0.45 per cent carbon steel, from 17 hours to 8 hours; on two large gear blanks of the same steel, from 20 hours to 8.3 hours; on two other gear blanks of the same kind of steel, from 10 hours to 5 hours; and on still another set of gear blanks, from 10.5 hours to 2.5 hours.

Large cast-iron spur gears which were formerly bored and faced in 2.3 hours are now completed in 38 minutes; and rotor end plates made from 0.45 per cent carbon steel forgings, which formerly required 8 hours for machining, are now finished in from 3 1/2 to 4 hours.

As another indication of the increased capacity of turret lathes, we find that on Gisholt machines of equivalent size, the horsepower has been increased in some instances from 3 to as much as 10 horsepower; from 7 1/2 to 15 horsepower; and from 15 to as much as 40 horsepower. This increase in power has been accompanied by an increase in weight of the machines amounting to as much as 20 per cent in some cases.

An Increase of from Thirty to Seventy Cylinder Blocks Bored an Hour

Cylinder boring machines now being built compared with those of ten years ago will give better than twice the production. Ingersoll cylinder boring machines of today produce from 65 to 70 blocks an hour, while the machine of 1926 produced only 30 blocks an hour, the blocks having cylinder bores of equal length, the same amount of stock being removed, and the same kind of finish produced.

There has also been a great increase in the productive capacity of cam and crank boring machines for the smaller high-production cylinder blocks. Compared with the machines of ten years ago, the

productive ratio is as 5 or 6 to 1—that is, blocks bored in 1926 at the rate of 15 to 20 an hour are now produced on Ingersoll machines at the rate of 75 to 90 an hour.

Ten Years' Improvement in Radial Drilling Machine Performance

The American Tool Works Co. records an average increase of 78 per cent in the drilling penetration of radial drills in a ten-year period. A 2 1/2-inch drill on a 4-inch plain radial drilling machine formerly removed about 8 cubic inches per minute. A machine built ten years later removes nearly 24 cubic inches. On the smaller sizes of drills, the difference is not so great; yet even with a 1/2-inch drill, which removed 2.8 cubic inches when mounted in an older machine, 4.3 cubic inches of metal is being removed by a recent machine.

The Cincinnati Bickford Tool Co. makes the following comparison between a radial drill ten years old and the company's present machine. To drill a 2-inch hole in cast iron 3 inches deep, in 1926, required 49 seconds—today, 20 seconds; to drill a 2-inch hole in low-carbon steel 3 inches deep, ten years ago, 65 seconds—today, 34 seconds; to drill a 1 1/4-inch hole in naval bronze 3 inches deep, ten years ago, 12.3 seconds—today, 4.6 seconds.

Comparing a number of drilling results, including cast-iron, bronze, and low-carbon steel, it is found that the average increased production due to faster drilling is 73 per cent. Furthermore, the newer machines are more rapidly manipulated, so that there is an additional saving in drilling time.

The greater power and rigidity available in the same size machines is called attention to by the Barnes Drill Co. Today, the 24-inch all-geared Barnes drill, for example, has a capacity of from 2 to 2 1/2 inches, as against from 1 1/2 to 1 3/4 inches in earlier designs, with the power increased from 5 to 7 1/2 horsepower.

The Old Standbys—the Lathe and Planer—Have Not Been Left Behind

Lathes and planers, the original types of standard machine tools, show as great improvement in productive capacity as other types of machine tools. The American Tool Works Co. has published data showing that lathes of the company's recent design will remove approximately 89 per cent more metal per minute than lathes of a ten-year earlier design. An earlier lathe would remove approximately 19 cubic inches of S A E 1045 steel per minute with a power input of 12 horsepower, whereas the corresponding size lathe ten years later removes over 36 cubic inches of steel per minute with a 20-horsepower motor.

As regards planers, the Cincinnati Planer Co. states that ten years ago the average cutting speeds were from 30 to 40 feet per minute—rarely 50 feet. The feeds were seldom changed because of the laborious method necessary to do this. Today, the average cutting speeds of planers are from 45 to 80 feet, and for the machining of aluminum and second cuts with tungsten-carbide tools, speeds are now available up to 230 feet per minute. Large savings in production time are also due to the ease with which the feed can be changed from 1/16 to 1 inch. Because of the quick feed change, finishing cuts are now nearly always taken at feeds ranging from 1/2 to 1 inch. Owing to improved gearing, and the weight and rigidity of planers, a finer finish and greater accuracy are obtained.

The newer shapers show an equally increased metal removing capacity. American Tool Works shapers, for example, in earlier models removed 3.33 cubic inches of metal per minute, as compared with 6 cubic inches ten years later.

How Gear Cutting has been Speeded up

On most materials used for gears, the Fellows Gear Shaper Co. estimates that production can be increased 20 per cent over what could be done ten years ago with the same size of gear shaper. Here we are simply comparing equivalent machines. However, there has also been a great advance in methods. For example, the Fellows enveloping gear generator will finish a 30-tooth, 1-inch face, 10-pitch gear in from 25 to 30 seconds, which formerly took from 2 1/2 to 3 minutes to finish on the high-speed gear shaper. There is, however, a difference in the amount of stock that can be successfully removed by the enveloping gear generator, as compared with the gear shaper. The latter machine can reduce the tooth thickness anywhere from 0.010 to 0.020 inch, whereas the enveloping gear generator will reduce the tooth thickness, in the time mentioned, only from 0.004 to 0.006 inch.

On Newark gear-cutting machines, speeds have been increased about 30 per cent in ten years, but due to the increased hardness and toughness of the iron and steel gears cut today, no greater feeds are feasible than were used ten years ago. Improvements in the facilities for setting up work have effected a saving of from 30 to 50 per cent in the setting-up time.

Feed Rate of Cold Sawing Machines Increased Six Times

In cutting low-carbon 9-inch diameter steel billets, the feed rate on Newton cold saws, as built by the Consolidated Machine Tool Corporation ten years ago, was approximately from 3/8 to 1/2 inch per minute. When an attempt was made to increase the feed rate beyond 1/2 inch per minute, there was excessive breakage of the saw teeth. The present design of the Newton hydraulic-feed cold saw makes it possible to cut low-carbon 9-inch diameter steel billets with a feed rate of 3 inches per minute without excessive breakage of the saw teeth, provided, of course, that the saw is kept in good condition and not allowed to become too dull.

Ideas for the Shop and Drafting-Room

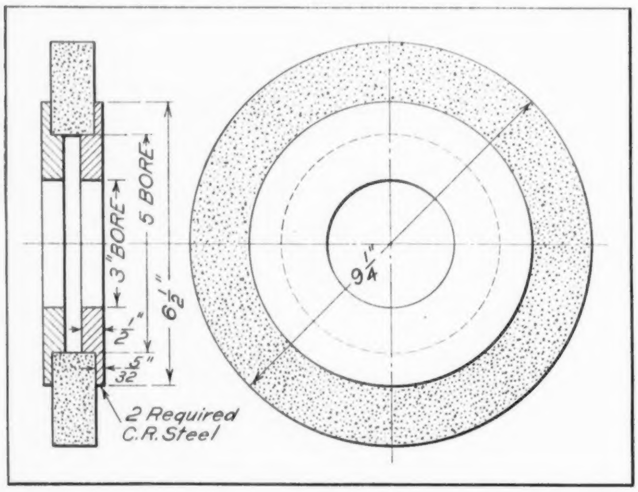
Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Adapter Flanges Permit Using up Worn Grinding Wheels on Small Spindles

In a certain plant, the wheels used on a large cylindrical grinder, when new, are 14 inches in diameter. They have a face width of 1 inch and a 5-inch bore. When worn down to a diameter of about 9 1/4 inches, they must be replaced, although considerable abrasive material remains. In the same plant, there is a smaller machine on which wheels of a similar grit and grade are used and which has a wheel-spindle 3 inches in diameter.

The flange bushings shown in the accompanying illustration make it possible to adapt the worn wheels for use on the smaller machine. The outer edges of the thin flanges of the adapter are so well supported by the clamping flanges that the wheels can be safely worn down to a diameter of 7 inches.

Millersburg, Pa. ROY A. DRESSLER



Cold-rolled Steel Flanges Adapt Worn Grinding Wheel for Use on Smaller Machine

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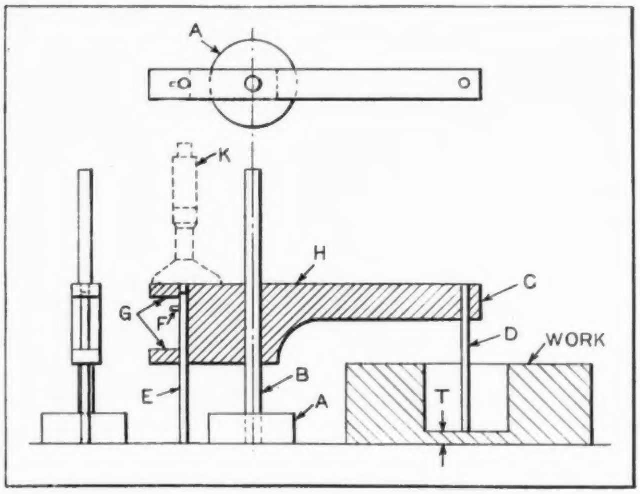
Preserving Marking on Side of Grinding Wheel

By placing grinding wheels on the spindles in such a manner that the markings on the sides of the wheels are next to the motor or bearing, the danger of the marking becoming effaced is less than if it were on the outer side.

Baltimore, Md. THOMAS TRAIL



Method of Using Depth Gage for Measuring Thickness T at Bottom of Blind Hole

Measuring Thickness of Piston-Heads with Depth Gage

The simple device shown in the accompanying illustration is used for the direct measurement of the thickness of piston-heads, blind counterbored holes, or similar work that cannot be measured with a micrometer in the usual manner. The base *A* consists of a piece of round steel in which spindle *B* is a drive fit. The pin *D* is a tight fit in the holder *C*. Pin *E*, which is exactly the same length as pin *D*, is a sliding fit in member *C*. A small stop-pin *F* prevents pin *E* from falling out, being stopped by the shoulders *G*.

The gage can be used on a surface plate or on any flat surface. In measuring the thickness of a piece such as indicated at *T*, part *C* is allowed to drop down until pin *D* touches the surface. Pin *E* then comes in contact with the surface plate. The distance from the top of pin *E* to the surface *H* is then equal to the thickness *T*, which is determined by measuring with a depth gage, applied as indicated by the dotted lines at *K*.

Hamilton, Canada F. MUIR

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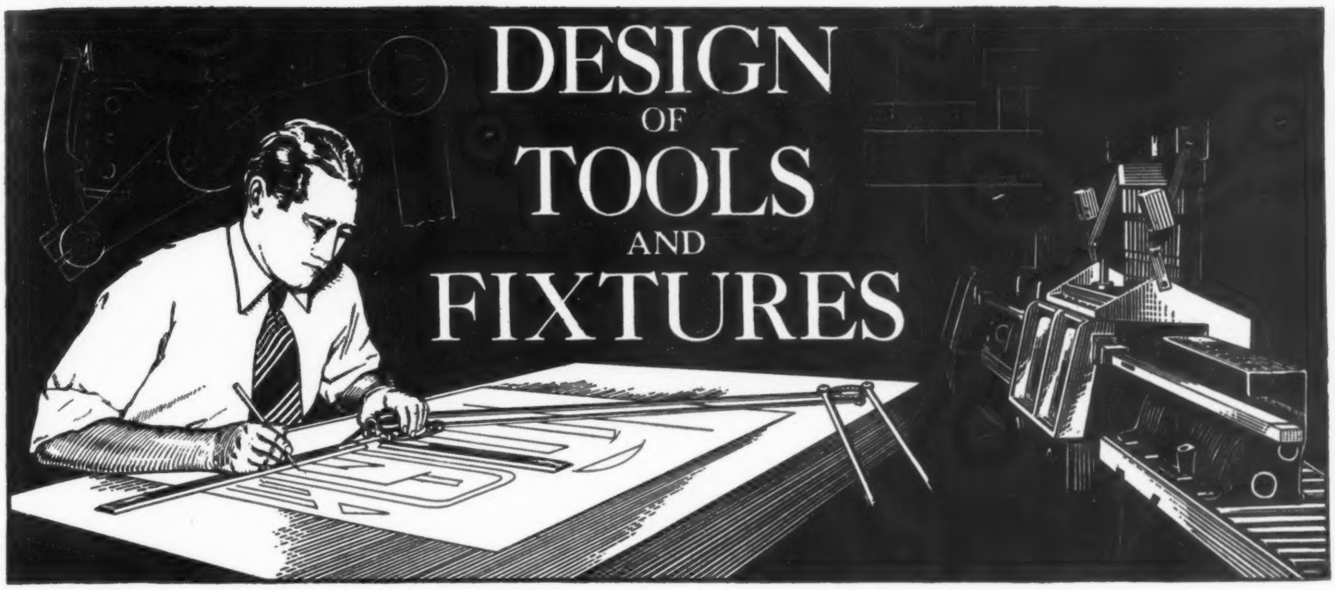
As far as we know, the Egyptians were the first people to work metals. According to the Copper and Brass Research Association, there is evidence that 8000 years ago the Egyptians knew how to hammer copper into knives and other implements.

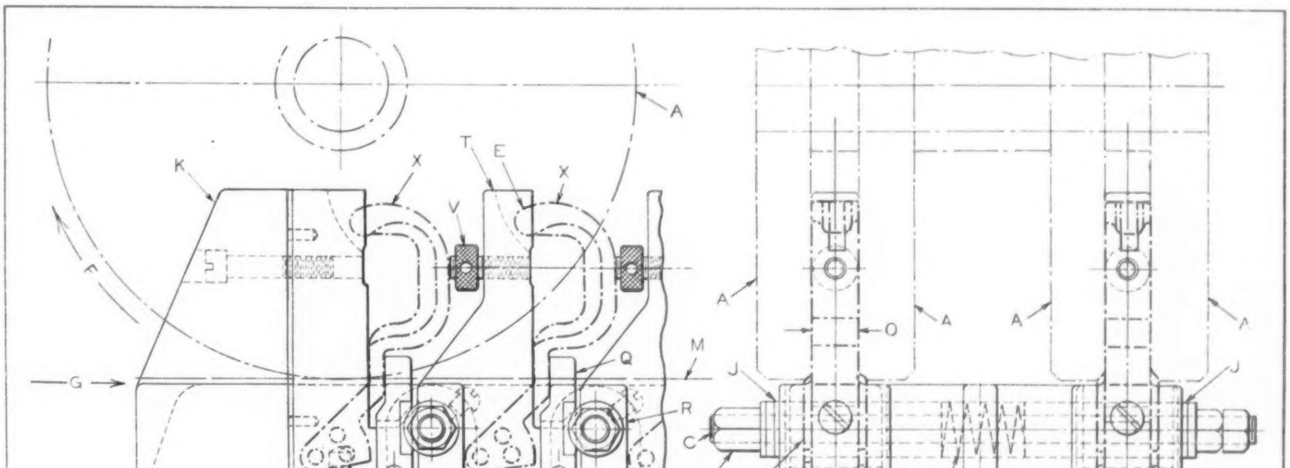


Fixture for Straddle-Milling a Number of Parts at Once

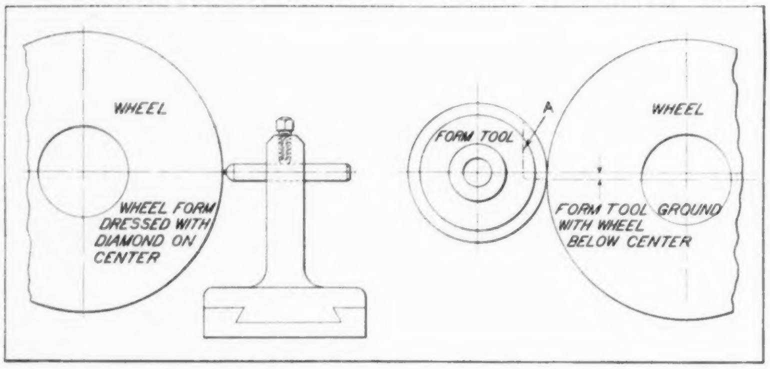
By F. SCRIBER

Eight rifle parts like the ones shown by heavy dot-and-dash lines at *X* in the accompanying illustration are mounted in two lines of four each in the fixture, so that the four cutters *A* will straddle-mill the sides to give the required width *O*. Each piece of work is rigidly braced to resist the thrust of the straddle-milling cutters, which take fairly deep cuts. The lower end of the work at *D* forms a fork, which fits over the sides of the supporting block. A lug *E* at the upper end of the work enters a slot in the block *T*, thus locating the work on the fixture, which is made up of steel blocks secured to a cast-iron base.

With the four cutters revolving in the direction indicated by arrow *F*, the fixture is fed in the direction indicated by arrow *G*, thus successively milling both sides of two parts *X* simultaneously, eight pieces being completed at one pass of the fixture. A rib extending lengthwise through the center of the fixture provides longitudinal rigidity, while two bosses *K* back up the work-holding blocks against the thrust of the milling cut. Another pair of bosses (not shown) at the right-hand end of the fixture holds the blocks at that end, making a very rugged construction below the cutting line *M*. Above this cutting line, the fixture members are narrow enough to allow the milling cutters to pass.



Two of the Four Work-holding Positions of a Fixture Designed for Straddle-milling Eight Rifle Parts at One Pass of the Cutters



Method of Dressing Formed Wheel and Grinding Form Tool

The two steel work-supporting blocks *N* and *P* are made as units with a clamp-holding section for the swinging clamps *Q*, together with the clamp screw portion *R* and four upright sections at *T* on each side of the fixture against which the work is clamped by the knurled screws *V*. The final tightening of these clamp screws may be accomplished by means of a rod passed through the cross-holes in the knurled heads. Each steel block is secured to the base by four screws, as shown.

After the eight parts *X* have been placed in the fixture in contact with surfaces *Z* and the screws *V* tightened to hold them in place, the four swinging clamps *Q* at each side of the fixture are caused to grip the work securely by tightening the four nuts *B*. This pulls in the draw-bolts *C* and causes the beveled bushings *J* to ride along the corresponding bevel surfaces of the swinging clamps *Q*, forcing them against the work as they pivot about pins *Y*.

In each clamp, there is a spring *L* which swings the clamp clear of the work to permit loading the fixture. A spring *H* at each clamping unit forces the bushings apart when the nuts *B* are loosened to release the hinged clamps. With this type of fixture, the cutters operate on the several parts in an overlapping manner. The long feeding movement gives the operator time to file the burrs from the milled parts while the machine is in operation.

Making Circular Forming Tools without Mathematical Calculations

By WILLIAM C. BETZ, Equipment Engineer
Fafnir Bearing Co., New Britain, Conn.

A circular forming tool that is to have the cutting edge set below center for clearance must have a profile that varies from that of the piece to be formed. The profile of the forming tool must be accurately determined by mathematical calculation or taken care of by special machining or grinding methods.

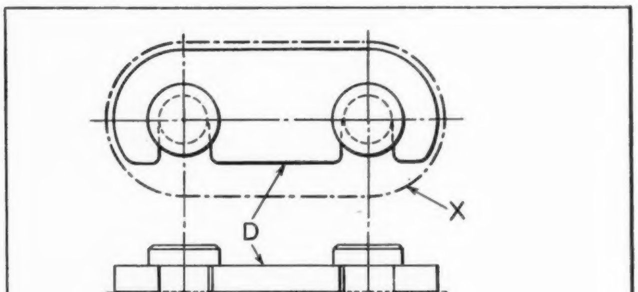
To grind forming tools to the correct shape without making any calculations, it is only necessary to set a formed grinding wheel below the center of the tool the amount required for clean cutting. This amount will vary with the size of the tool and the material to be cut. For average tools, 3 to 3 1/2 inches in diameter, 1/8 inch below center will give ample clearance for forming steel, and 3/16 inch is enough for non-ferrous metals.

In using this method, the correct form or shape is produced in the grinding wheel face with the diamond wheel-dresser set to the exact center height of the wheel, as shown in the view to the left in the accompanying illustration. The grinding wheel is then lowered to a position below the work centers an amount equal to the clearance that is required in the finished tool, as shown in the view to the right, after which the tool is ground to fit a templet set at this position. The tool is next gashed, as shown by the dot-and-dash lines at *A*, and ground with the cutting face an amount below center equal to the "below-center" grinding position.

If the tool is not ground to shape, but is formed in a lathe, a flat formed master tool must be used. This master tool must be set the amount below center required for clearance in the finished circular tool.

Profiling Fixture with Slip-On Clamp

The fixture shown in the accompanying illustration is provided with a quick-acting clamping arrangement for holding the piece shown by the



Fixture Used for Profiling Operation

heavy dot-and-dash lines at X while profile-milling around the entire outline. The work is located over two studs A and B, and is clamped down against the plate C by means of the yoke D. Grooves on the hold-down studs permit sliding the yoke D into the clamping position.

Attached to the lower end of studs A and B is a plate G. The cam at J which is in contact with plate G is revolved by lever K. This cam action causes plate G to move down and clamp the work through the medium of yoke D. Springs at L serve to raise the studs when cam J is reversed to release the work. Thus the simple operation of sliding yoke D off the grooves of the studs permits the work to be lifted from the fixture.

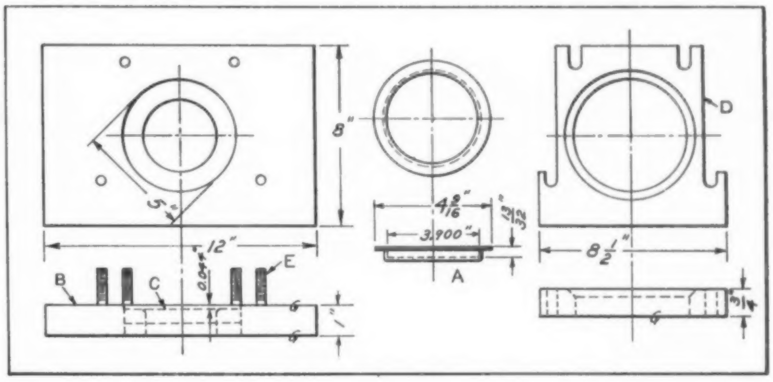
H. M.

Die for Forming Stainless-Steel Cups

By DANIEL L. MATHER, Malden, Mass.

Stainless-steel cups of the shape shown at A in the accompanying illustration are drawn from stock 0.044 inch thick in lots of fifty on the inexpensive die illustrated. The die consists of the cold-rolled steel plate B with the tool-steel insert C and the combination pressure plate and stripper D. The draw-ring insert C has the same outside diameter as the stainless-steel blank and is ground so that its upper surface is 0.044 inch below the upper surface of plate B when pressed into place to form a nest for the blank.

The combination pressure plate and stripper D is made to slide under four shoulder nuts (not shown) which are threaded on studs E. These nuts are merely loosened to permit removing the plate D after the work is formed. This die has given satisfactory results and produces the flanged cup without wrinkling the flange.



Simple Drawing Die for Flanged Cup Shown at A

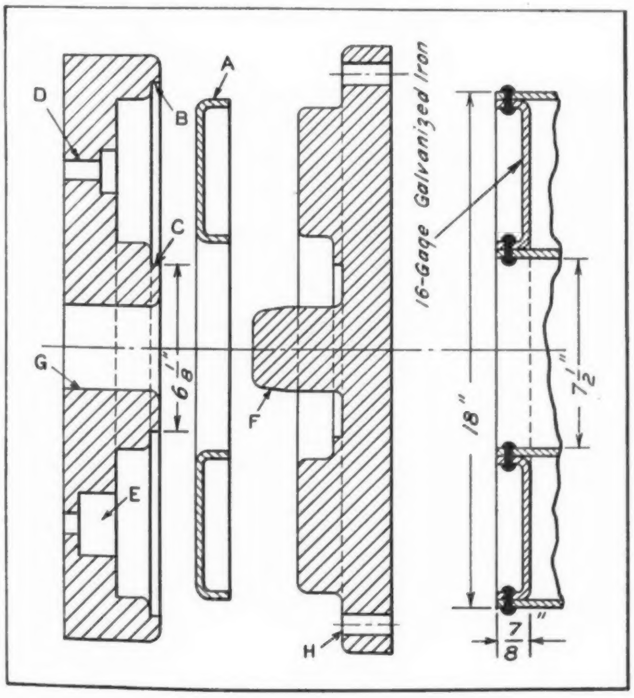
How to Make Inexpensive Dies for Small-Lot Production

By CHARLES C. TOMNEY, Chief Tool Designer
Carrier Corporation, Newark, N. J.

The problem of providing an inexpensive die for forming small lots of flanged bottoms for congealing tanks was solved fifteen years ago by making a cast-iron forming die for use on a horizontal hydraulic press. This die, made as shown in the accompanying illustration, is still in use and in good condition, after having formed about 500 tank bottoms a year for the last fifteen years. This record shows the practicability of using cast-iron dies for metal-forming operations where the product is made in comparatively small lots.

The flanged tank bottoms, one of which is shown at A, are made from 16-gage galvanized iron, the blank being cut to size on a circular shear. The particular die shown is used in producing a bottom for a tank 18 inches in diameter by 20 inches high. Similar dies are also used in making bottoms for tanks 24 inches in diameter by 24 inches high. The method of riveting the bottom to the outer and inner cylinder walls of the congealing tank is shown in the view to the right.

The outside diameter of the blank is a loose fit in the counterbore B of the die, which is 19 5/8 inches in diameter. The hole in the blank fits over the pilot C, which is 6 1/8 inches in diameter. Three equally spaced holes D are provided for bolting the die to the ram of the press, and there are three holes E for work-ejecting springs. The other half of the die has a pilot F which fits hole G. The holes H are used for bolting the die to the ram. The bolts used for this purpose must be easily accessible, in order to facilitate aligning the dies in the press.



Cast-iron Die Used for Producing Small Lots

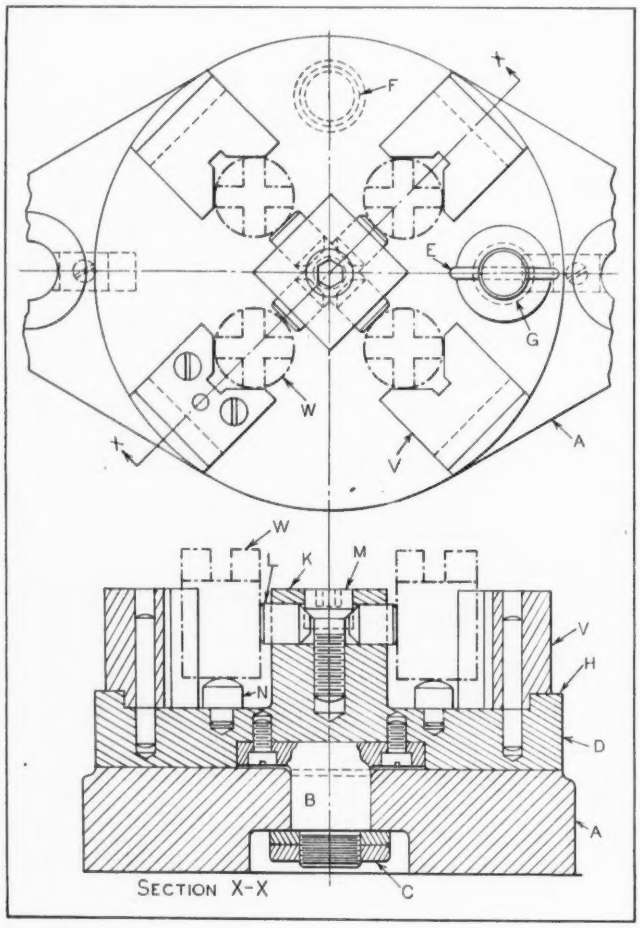
Cross-Slot Grinding Fixture

By JOHN A. HONEGGER, Bloomfield, N. J.

An order for several thousand hardened-steel coupling connectors led to the building of the grinding fixture shown in the accompanying illustration. This fixture is designed to hold four coupling connectors *W* while grinding the cross-slots in their upper ends. A similar fixture is used in milling the slots previous to hardening the connectors. The milling fixture, however, has backing heels *H* on the baseplate *D* which extend the full height of the V-blocks *V*.

The base *A* is fitted with a pilot stud *B* and check-nuts *C*. Baseplate *D* is secured to stud *B* and can be indexed through an angle of 90 degrees by means of the pin *E* which enters the hardened bushings *F* and *G*. The four V-blocks *V*, of hardened steel, are doweled and screwed to baseplate *D*, being backed up by the heels *H* of the baseplate. The square center section *K* machined on the baseplate has four drilled and reamed holes in line with the V-blocks. These holes receive the plungers *L* which clamp the couplings in place when the hexagon-head screw *M* is tightened.

The work rests upon the locating buttons *N* while being ground. The milled slots in the parts are squared up in the grinding fixture by employing gage pieces which just fit into the slots of two opposing couplings, thus bringing their slots parallel to each other.

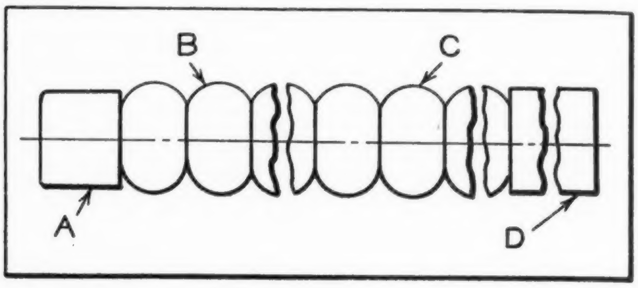


Indexing Fixture for Grinding Cross-slots in Four Parts at One Setting

Finishing Babbitt Bearings by Burnishing

By VERNON E. DAVIS, Poughkeepsie, N. Y.

In a certain plant, the finishing of babbitt bearings by burnishing, instead of by the reaming method, has resulted in a great reduction in production costs, as well as in a better finish for the bearings. When an attempt was made to speed up the reaming operations, the tool left chatter marks, whereas a fine mirror finish, with the babbitt firmly set in the casing, is now produced in from one to two minutes by burnishing with a tool of the well-known type shown in the accompanying illustration.



Burnishing Tool Used in Finishing Babbitt Bearings

The end *A* of the burnishing tool is finished to a size that permits it to enter the unfinished bearing freely. Each step *B* is usually made from 0.003 to 0.005 inch larger than the preceding one, the last section *C* being the finished size of the hole. As many burnishing rings or surfaces are used as are required by the individual job. End *D* is smaller than the finished bearing.

A bearing can be finished by forcing the burnishing tool through once, using an adequate supply of oil. The holes in the babbitt bearings taper 1/64 inch in 5 inches. The burnishing tool is entered at the small end of the hole in the bearing and is pushed through on an arbor press. The tool extrudes the babbitt, causing it to pack solidly against all parts of the bearing casing. The section *B* must be spaced unevenly to avoid a wavy finish and insure leaving a highly polished hole that is ready to receive the shaft. If the bearing is to be bored, this operation should leave it small or under size for finishing with the burnishing tool. Either solid or split bearings can be finished by burnishing. There will be no porous or hollow spots in the babbitt when it is finished by burnishing, and no reaming or scraping will be required afterward, except, perhaps, in cases where very high speeds are to be employed.

Ambrose Swasey, Dean of Engineers, Celebrates Ninetieth Birthday

AMBROSE SWASEY, chairman of the Warner & Swasey Co., Cleveland, Ohio, whose receipt of the Hoover Gold Medal, awarded by America's four leading engineering societies, was mentioned in December MACHINERY, page 240, celebrated his ninetieth birthday on December 19. Mr. Swasey, a pioneer builder of turret lathes, telescopes, and other precision instruments, today holds all the major honors within the power of his fellow-engineers to bestow.

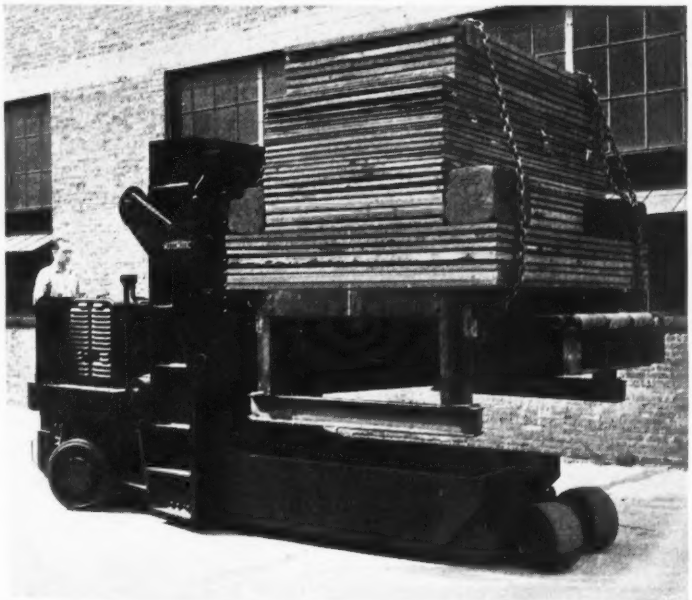
Born at Exeter, N. H., December 19, 1846, Mr. Swasey began his career as an apprentice in the Exeter Machine Works at the age of eighteen. Here he met a fellow-apprentice, Worcester Reed Warner, forming a friendship with him that ripened into a lifelong business association in the Warner & Swasey Co. In 1869, the two young men went together to the Pratt & Whitney Co., Hartford, Conn., where both soon won recognition for their outstanding abilities. In 1880, they embarked upon a business venture of their own, opening a small shop in Chicago which, however, was transferred to Cleveland the following year, where the first Warner & Swasey shop was built in 1881—a plant that has become known the world over for the machine tools and telescopes built there.

Friends from near and far honored Mr. Swasey on his ninetieth birthday, paying tribute to his outstanding achievements as a machine tool builder, an engineer, a friend of science, and a man who is deeply beloved by all who have come in contact with him.

Facts Show that Machines Have Increased Employment

THE Machinery and Allied Products Institute, 221 N. LaSalle St., Chicago, Ill., has published a booklet entitled "Machine-Made Jobs," provided with a sub-title as follows: "The 'Buts' and 'Ands' that Must be Considered in Connection with Common Statements which on the Surface Appear to Prove that Machines Cause Unemployment."

The book gives a mass of interesting figures that show conclusively that with the machine, industrial employment has increased in the United States. It deals not only with the machine manufacturing industries, but also shows how employment has increased in the printing industry with the development of more and better printing presses; in office employment, with more and better typewriters, adding machines, and other business machines; in the textile industry, with more and better textile machinery; and in road-building, with more powerful steam shovels. It is easy to jump at conclusions as to the causes of unemployment, but it is hard to refute definite cold facts. The machine has made jobs, not reduced them.



Dies and Other Work Weighing 30 Tons can be Handled by this Gigantic Platform Lift-truck, Recently Built by the Automatic Transportation Co., Chicago. This Truck is Believed to be the Largest of Its Type in the World

Surface Grinding in Building

SURFACE grinding is employed extensively by the National Acme Co., Cleveland, Ohio, for the accurate finishing of plane surfaces on parts for automatic screw machines, because this method has proved both economical and rapid. Six distinctive types of machines equipped with cup, ring, and disk abrasive wheels are used on a wide range of work. Typical operations are shown in the illustrations.

Precision Surface Grinding on Machines of the Reciprocating Table Type

Surface grinding on a production basis is illustrated in Fig. 1. The work consists of cast-iron pump bodies that measure approximately 9 by 12 by 2 inches. The machine is fitted with three magnetic chucks, each of which has a working surface of 40 1/2 by 16 inches.

Usually ten pump bodies are ground simultaneously, instead of seven as shown. The practice is first to rough-grind the pump bodies on a vertical surface grinder until they are only about 0.015 inch over size. Then they are normalized, and finally finish-ground in the operation illustrated within a thickness tolerance of plus or minus 0.001 inch. This is a comparatively close tolerance when the size of the work is taken into consideration. The grinding wheel has a face width of 6 inches, and therefore the table feed can be as much as 1 inch for each stroke of the table. This speeds up the operation considerably.

A production operation that consists of grinding both sides of bronze shoes for clutch mechanisms within plus or minus 0.002 inch is illustrated in Fig. 2. These shoes are 2 1/2 inches long by 3/4 inch wide. Thirteen shoes are ground at one time.

Since these parts are made of a non-ferrous material, they cannot be held on the chuck magnetically, and so they are nested between steel backing pieces. The magnetic chuck holds the steel pieces firmly in place, and they, in turn, prevent the work from slipping either endwise or sidewise. As the grinding pressure is always downward in this operation, a wide-face grinding wheel is used. About 0.005 inch of stock is ground off each side of these parts with the table operating at a speed of 40 feet per minute.

In many instances, special fixtures are necessary for holding the work, as in the operation shown in Fig. 3. The work is a tool-holder having three angular surfaces that must fit a slide accurately. It will be seen that the work is located on an arbor, which is fitted into a special indexing fixture clamped to the table of the grinding machine. An index-pin is entered successively into three hardened bushings in this fixture in order to locate the work properly for the three grinding steps. This tool-holder is a steel casting, approximately 0.010 inch of stock being allowed on each surface for removal by grinding.

Previous to the grinding operation, the angular surfaces are milled. They are finished so accurately in the grinding operation that the part can be fitted to its tool-slide with little or no scraping.

Two bearing surfaces, 7 inches long by 9/16 inch

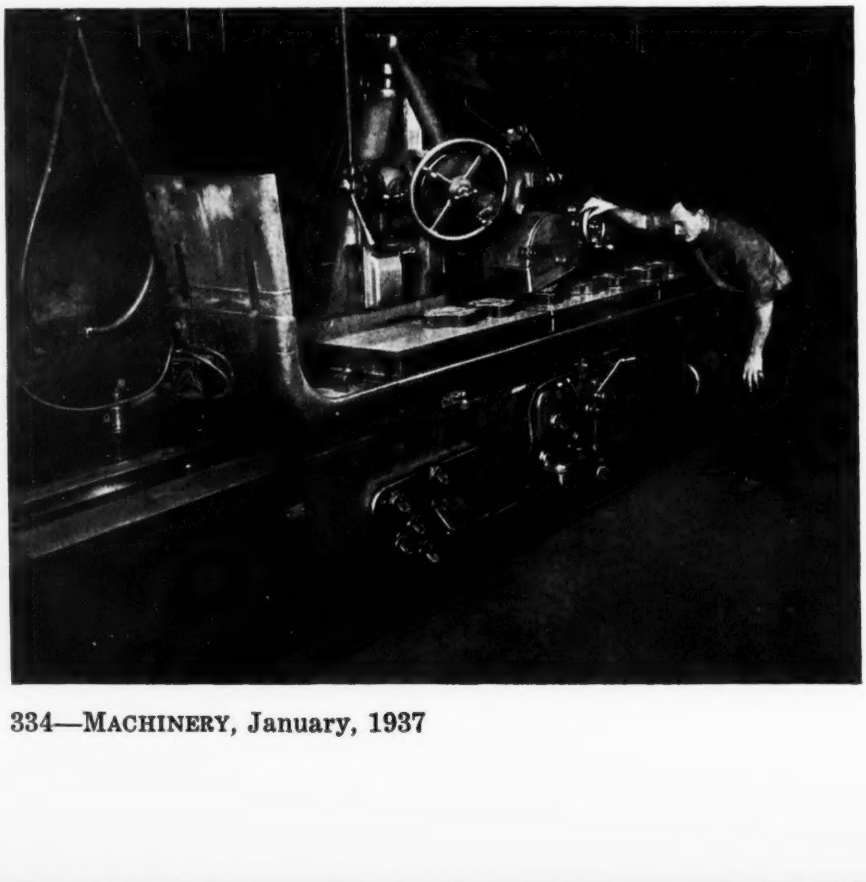


Fig. 1. Surface Grinding Finishes Work Fast and Accurately in a Machine Tool Plant. The Illustration Shows a Quantity-production Operation on Pump Bodies

Machine Tools *By* FRED B. JACOBS

wide, must be ground on each of the three die-slide guides shown on the surface grinding machine in Fig. 5. The practice is first to grind the surface at the rear of the parts, and then move the grinding wheel toward the front of the machine for finishing the second surface on each part. By thus grinding the two surfaces with one setting of the work, it is an easy matter to finish them in the same plane, and accurate as to parallelism. The parts are made of cast iron and are ground at a table speed of 25 feet per minute.

An operation that facilitates assembly work is illustrated in Fig. 4. The piece being ground is a steel key that is used for locating a cam-drum on a shaft. This particular key is 10 inches long, 7/8 inch wide, and 5/8 inch thick.

It is not always necessary to machine keys to make them fit, but when any amount of material must be removed, surface grinding insures an accurate key of the right dimensions with little loss of time. In the National Acme plant, two surface grinders of this type are used for a diversity of fitting operations.

Another operation that is frequently necessary in assembly work is shown in Fig. 6. It consists of removing a slight amount of stock from the side of a thrust collar in order to obtain the desired fit. The particular thrust collar being ground is bronze and therefore could not be held on the magnetic chuck. For this reason, it was mounted in an auxiliary chuck fitted with three jaws that can be tightened firmly on the work by means of adjusting screws. As only a little pressure is required to hold the work securely, it does not become distorted by this method of holding. The auxiliary chuck is, of course, held in place magnetically.

Using Parallel Blocks to Support the Work on Vertical Surface Grinding Machines

Steel locking blocks 3 1/8 inches high are finished on both ends by the vertical-spindle grinding machine illustrated in Fig. 7. Because these pieces are considerably longer than they are thick, it is necessary to provide parallel blocks, as shown, to hold them in place on the magnetic chuck. After the parts are finished on one end, they are turned for finishing the opposite end. They are ground at a table speed of 15 feet per minute.

The work on the magnetic chuck of the surface grinding machine shown in Fig. 8 consists of ten steel gibs, each 16 1/2 inches long, 1 9/16 inches wide, and 5/8 inch thick. These gibs are placed in lots of five between parallel blocks that are slightly less high than the work. Parallel blocks are also placed at both ends of the gibs. The parallel block between the two groups of work is necessary to provide a clearance space for the wheel at the center of the chuck. As in the operation shown in Fig. 7, the machine is equipped with a grinding wheel of the ring type.

Semi-steel tool-slides are being ground with a segmental type wheel in the operation illustrated in Fig. 9. The ground surface on each slide measures approximately 7 by 8 inches, and five slides are ground at one time. The parts are rough cast-

Fig. 2. Grinding Non-ferrous Parts for a Clutch Mechanism on a Magnetic Chuck by "Nesting" them between Steel Pieces that can be Held in Position Magnetically

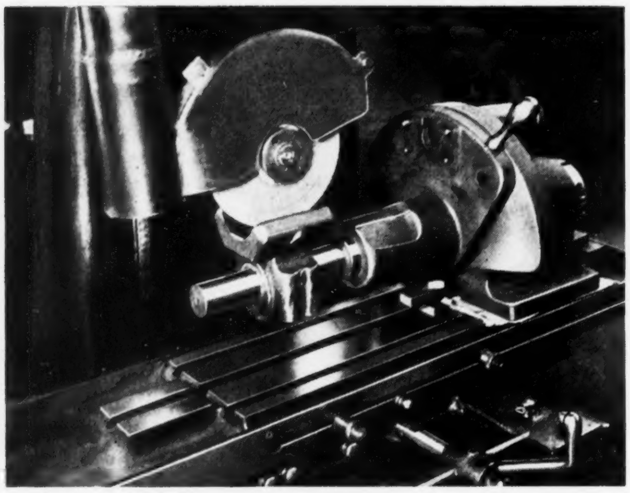


Fig. 3. Special Indexing Fixture that Enables Three Surfaces to be Ground in Accurate Relation to Each Other

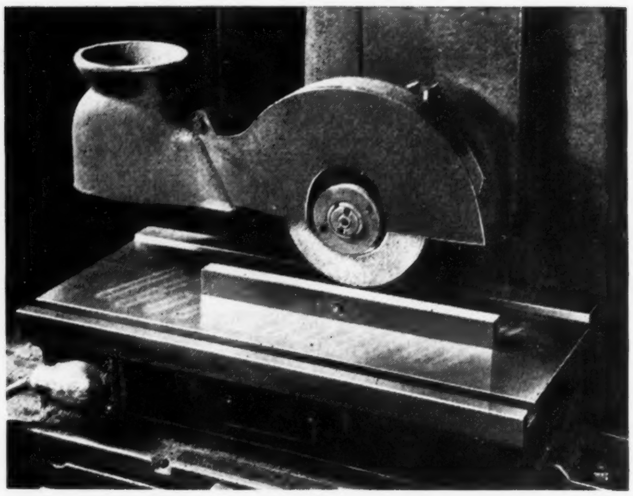


Fig. 4. Surface Grinding Provides a Convenient Method of Removing Small Amounts of Stock in Assembly Work

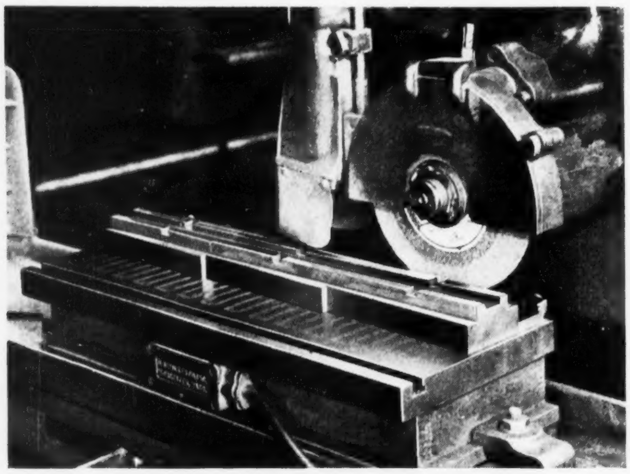


Fig. 5. Grinding Two Surfaces that Must be Closely Parallel on Guides for Die Slides. Three Pieces are Ground at Once

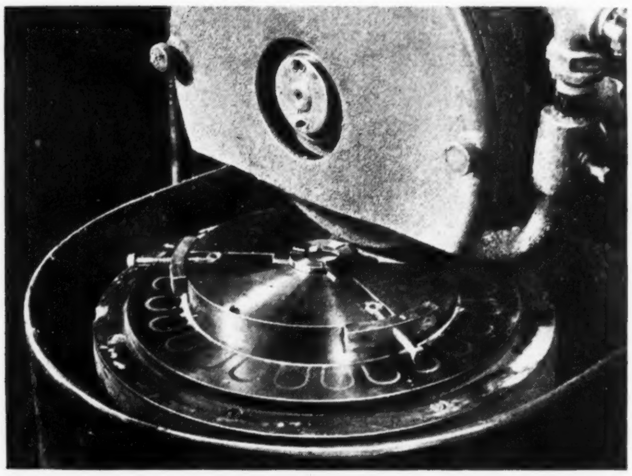


Fig. 6. Grinding One Side of a Thrust Collar to Obtain the Desired Fit in Assembling a Machine Unit

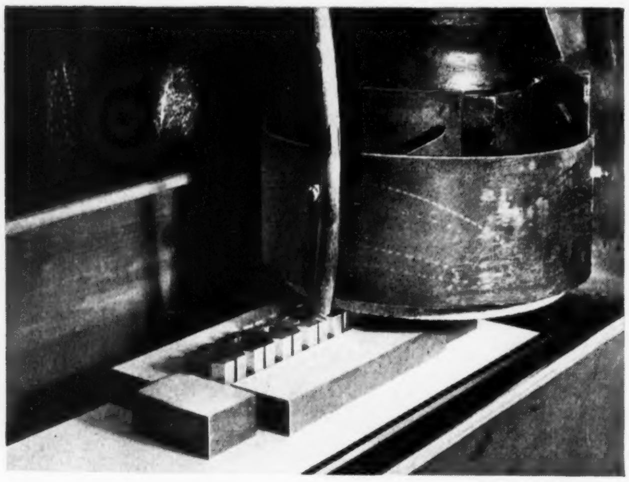


Fig. 7. Parallel Blocks Facilitate Grinding the Ends of Pieces that are Much Longer than they are Wide

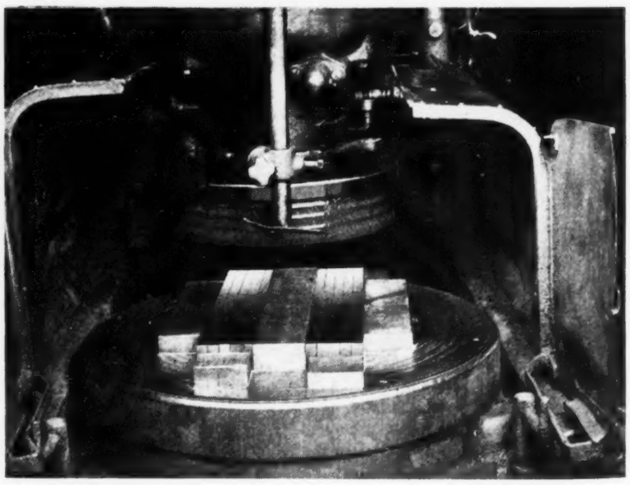


Fig. 8. An Arrangement of Parallel Blocks that Provides Wheel Clearance in Grinding Steel Gibs

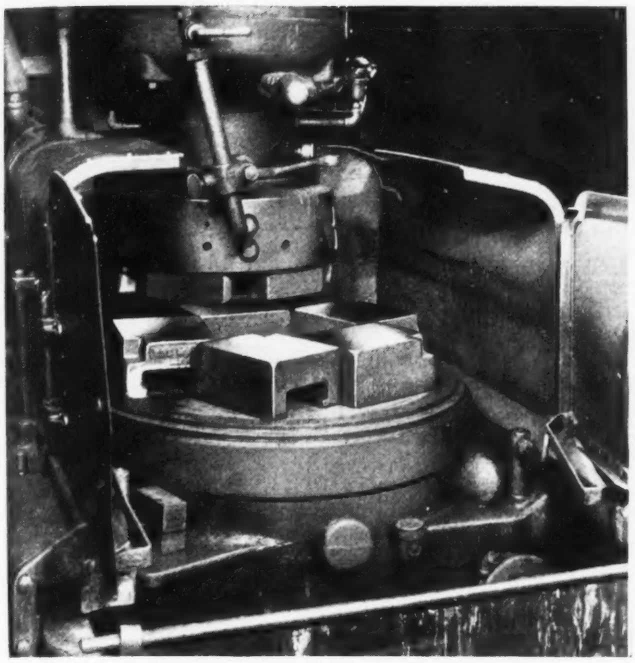


Fig. 9. A Retaining Ring Prevents these Semi-steel Castings from Sliding off the Chuck while being Ground

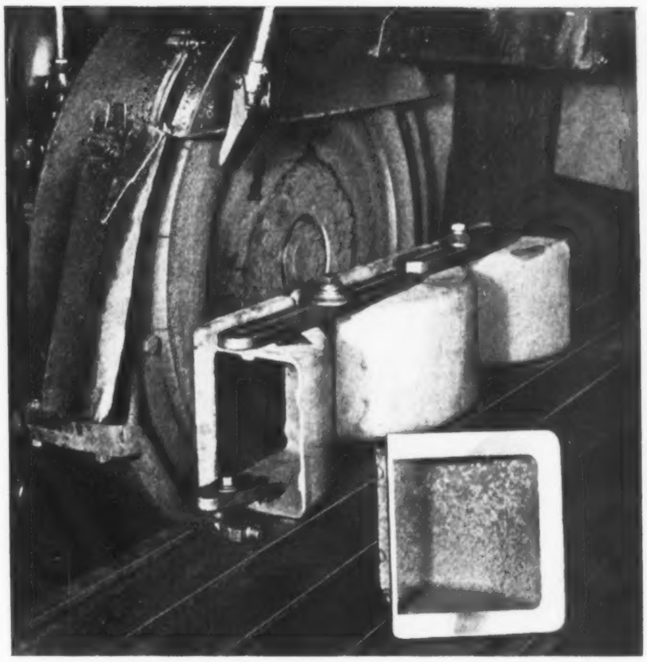


Fig. 10. A Rough-grinding Operation is Performed on Cast-iron Guards to Obtain a Level Mounting Surface

ings when they come to this operation. They are placed within a retaining ring on the chuck face that keeps the work from shifting under the pressure of the grinding wheel.

The grinding wheel consists of six segments, 6 inches long by 2 inches face width. They are built up into a wheel of 20 inches outside diameter. The chuck speed is about 20 revolutions per minute. In Figs. 8 and 9 it will be observed that the chucks are in the forward or loading position. For the grinding operation they are, of course, fed back under the wheel.

The sides of heat-treated steel gears are finished on a surface grinding machine fitted with a magnetic chuck that rotates in a horizontal plane and a grinding wheel that revolves in a vertical plane.

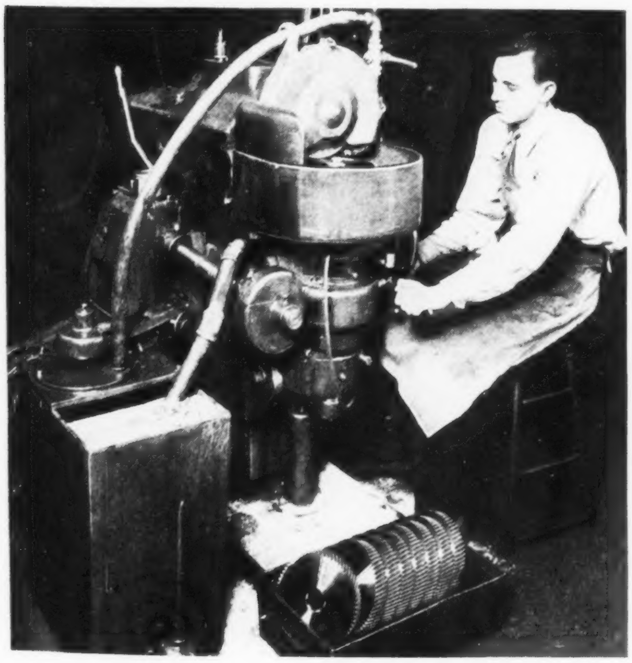


Fig. 11. Grinding One Face of Gears Accurate with the Splined Bore by the Use of a Special Arbor

Fig. 12. Disk Grinding Provides a Quick Means of Obtaining a Flat Surface on a Wide Range of Parts

This operation is illustrated in Fig. 11. Each gear is located by its splined bore on a special arbor that holds the side to be ground square with the bore. The opposite side of each gear is ground later in an operation on machines of the type illustrated in Figs. 7, 8, and 9, a quantity of gears being ground at one time. The gears shown in Fig. 11 are 8 1/4 inches in diameter by 1 1/2 inches thick.

Disk grinding is also used to finish plane surfaces, and is therefore a form of surface grinding. Disk grinders are used by the National Acme Co. for removing scale from one or more surfaces that must be flat but do not need to be in accurate relation to other finished surfaces. Fig. 12 shows a disk grinding machine being used for grinding the end of a cam for automatic screw machines. The part is a steel casting which the operator merely holds down by hand on the revolving disk against a stop-bar that prevents the work from turning with the disk. This is a preliminary operation, in which only enough material is removed to provide a level surface from which the part is located in subsequent operations.

Another rough-grinding operation, performed on a reciprocating table surface grinding machine, is illustrated in Fig. 10. The parts are cast-iron guards which are clamped four at a time directly to the machine table. Just enough material is removed to clean up the surfaces, which measure approximately 12 by 14 inches.

* * *

Directory for Users of Mailing Lists

The Bureau of Foreign and Domestic Commerce, Washington, D. C., has published a directory of firms prepared to supply mailing lists for various industrial purposes. This mailing list directory consists of two sections, the first of which contains the names of firms prepared to supply mailing lists, arranged alphabetically by cities, in two groups, one giving the names of firms whose lists cover the entire country, and the other those dealing in regional, state, and local lists. The second section contains an index dividing the firms supplying lists into those handling a general line, and those dealing in various kinds of specialties. The directory is available without charge to business men who address their request, on business letterheads, to the Marketing Research Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C.

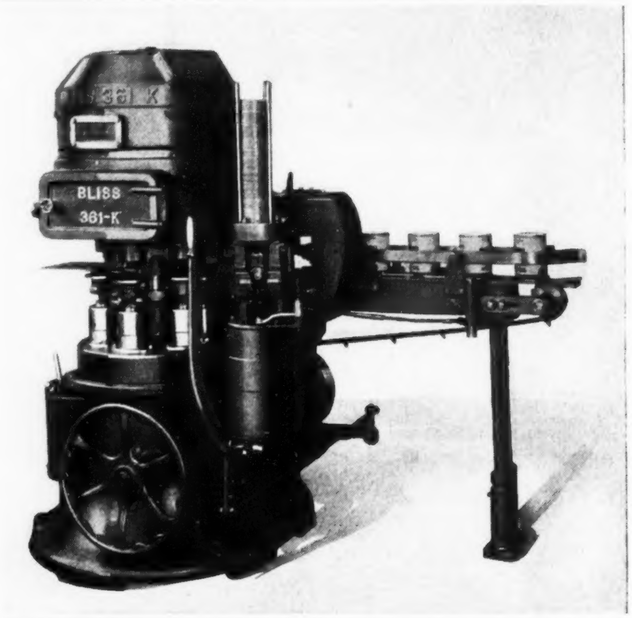
* * *

The public schools largely fail in one of the fundamentals required in life by every boy and girl. They do not emphasize the fact that making a living is a fundamental necessity in life, nor do they properly train for it. Seldom does the ordinary public school graduate even know the first principles of how to apply for a job.

Two Hundred Containers Closed per Minute

Tops are closed on one-quart cardboard cans that have been filled with oil, at the rate of from 175 to 200 cans a minute—approximately three a second—by the machine here illustrated. An even faster speed is attained in seaming the bottom to empty tin cans, it having been found possible to run the machine fast enough to seam 300 cans a minute. The machine is of the double seam type and is an improved model recently brought out by the E. W. Bliss Co., Brooklyn, N. Y.

Among the features of the machine are a non-spilling arrangement for feeding the cans and a marking device. Cans from Nos. 1 to 3 can be handled. The machine is equipped with a V-belt drive.



Machine that Seams Tops on Cardboard Containers at the Rate of 200 a Minute or Bottoms on Tin Cans at the Rate of 300 a Minute

* * *

There is Nothing New under the Sun

Referring to the mechanism for producing rotating and traversing movement illustrated and described on page 188 of November MACHINERY, M. Jacker of Oakland, Calif., calls our attention to the fact that a somewhat similar device was attached to Pratt & Whitney lathes for correcting errors in lead-screws some sixty years ago. A description and illustration of this device, Mr. Jacker states, may be found in the second edition of "Modern Machine Shop Practice," by Joshua Rose, Volume 1, page 180. This work was published about forty-five years ago.

The Influence of Welding on Machine Design and Shop Practice

Designing for Welding Requires a Different Approach from that Used in Designing for Forging or Casting—Paper Read by Erik Oberg, Editor of MACHINERY, before the Annual Meeting of the International Acetylene Association in St. Louis—Second of Two Installments

IN the first installment of this article, published in December MACHINERY, the freedom of the designer in using the welding process was emphasized, but a word of caution may not be out of place. It is true that the designer of welded machines is relieved of all consideration of the patternmaker and the molder; still he must not so elaborate his design that an excessive amount of welding becomes necessary. If he does, the economy obtained through the elimination of patterns and the advantages derived from welding will be largely lost. It is just as necessary for the designer to know definitely how to design for economical welding as it has been in the past for him to know how to design for the economical making of patterns and castings.

It is highly important that the designer used to conventional methods should thoroughly appreciate the fact that, in changing over to the welding process, the design must be suited to welded construction. It is not at all certain—in fact, it is not even likely—that a design worked out for forgings and castings would be suitable when made up entirely from welded sections. The result, both from the point of view of appearance and of strength, is not likely to be satisfactory if the design of a casting, for example, is imitated with welded bits of plate, angle-iron, and I-beams. The casting was designed for the casting process, and the welded design must be made to suit the welding process.

It has been pointed out that if a cast-iron frame, for example, is duplicated in welded steel, web for web, but using thinner sections, much weight will be saved and the cost reduced; but it is likely that there will be less torsional stiffness and possibly difficulties from vibration. However, it is perfectly feasible to make a welded design, using no more steel, but disposing of the steel differently, so as to obtain both the required stiffness and freedom from vibration.

One of the authorities on welded design constantly emphasizes that this new problem in machine design is by no means simple. In the first place, machine design is nowhere nearly as exact a science, for example, as structural design is. It is comparatively easy to determine the stresses in a bridge or a roof truss, but quite another matter to determine the stresses in a machine frame. The loads are not imposed in the simple manner that they are in a structural design. The frame frequently resembles a hollow box, upon which stresses are imposed in numerous places and in various directions. As a result, the stress distribution becomes extremely complex.

Some of the Points the Designer of a Welded Structure Must Consider

In machine design, the desirable physical characteristics of welds vary with the purpose for which the welded part is to be used. In one case, for instance, resistance to fatigue may be the most important quality; in another, it may be a high yield point. When there is a reciprocating load, fatigue resistance is highly important. This is the case, for example, in power presses, shapers, planers, or milling machines. Ductility, again, is a prime requisite in the construction of tanks, containers, piping, and machinery subjected to heavy loads, such as cranes and steam shovels.

In cases where a slight permanent set in the welded parts will lower the efficiency or hamper the operation of a machine, the yield point of the weld metal is important. A crane runway, the guides or ways of a machine tool, the frame of a power press, and the bodies of jigs and fixtures are examples of welded structures where a high yield point is required in the weld, and consequently in the weld metal. No matter how high the ultimate strength may be nor how good the ductility of the metal is, a low yield point in the weld metal would produce inferior equipment of this kind. A high yield point means that a machine can be operated with a heavier load and with a greater factor of safety.

Finally, resistance to shock or impact should be the determining quality in the welds for such equipment as tractors, press brakes, and steam-

shovel dippers. Furthermore, the weld metal used in successful machine design should have a resistance to corrosion equal to that of the parts welded; otherwise, the result is likely to be unsatisfactory in the long run.

In the earlier days of welding, considerable difficulties were encountered through the warping and deformation of welded-steel machinery parts. However, methods of controlling warping have been developed that are successful in most instances; and in a few cases where warping cannot be entirely prevented, straightening methods have been devised that appear to give entire satisfaction.

The Designer's Choice between Welded and Cast Structures

One thing that the machine designer must not overlook is to estimate conservatively to what extent welded structures can economically replace steel and iron castings. While in most cases welded structures are cheaper, especially when only a few castings are required, nevertheless the subject should be looked into, because under certain circumstances, when a large number of castings are needed, a casting may be cheaper because of its peculiar design or use.

There are cases when a casting may be more advantageous than a welded design. For example, in the making of a large number of duplicate, somewhat intricate housings, castings may be preferable. You can core oil passages, for example, and castings are sometimes used when the cast iron is desired as a bearing metal. Furthermore, if large surfaces must be machined, cast iron can be finished more quickly than steel; but, again, welded structures can be filled and painted at about 40 per cent less cost than castings, so that the higher costs in machining may be counterbalanced by savings in the paint shop. Many interesting problems arise and each one must be solved by the application of common sense.

Probably the greatest advantage to the designer of welded structures is that he is not handicapped by the necessity of designing sections simply for the purpose of facilitating the flow of molten metal to overcome shrinkage stresses when the casting cools, and to provide, as in the case of malleable-iron castings, the right type of casting for annealing. Often, to meet these requirements, the designer has to compromise with his best judgment as to how the casting actually ought to be designed to resist the stresses that will be imposed upon it.

In designing a welded structure, almost his entire attention can be given to resist stresses. Furthermore, he need give no thought to supporting cores, shrinkage provisions, or schemes for drawing the pattern from the mold. Hence, as one authority on both casting and welding says, "Welding unshackles the designer from many bonds of casting etiquette." Hollow column construction, which is ideal where torsional stresses are encountered, and closed box designs become extremely simple in welded machine frames and columns, while they present extreme difficulties to the foundryman.

Welded-steel structures, therefore, have great advantages as regards simplicity of design. They must, however, also compete with the corresponding cast design in the cost of the structure itself, in the cost of machining, and in strength. It has repeatedly been demonstrated that, in most instances, the welded structures compete successfully in the cost of the structure itself. It can be machined as easily as cast steel, but there is some advantage in this respect in favor of cast iron. In strength and ductility, again, the welded structure is likely to be superior.

One precaution that might finally be emphasized is that design for welding is no different from any other type of designing. It cannot be done on a haphazard basis. It must be as carefully considered as the design of a casting or forging. Extremes should be avoided; and while it is possible to do a great many things by welding that could not formerly be done, there are limitations, and the designer must not get into the frame of mind that welding will solve every design problem.

Cutting and Welding in Maintenance Work Defers Obsolescence

One of the great advantages offered by the use of welding in machine construction is the ease with which the problems of rehabilitation and maintenance of plant equipment may be solved. In the carrying out of all classes of repair work, the substantial savings that are likely to be effected by the use of welding and cutting processes now available are obvious. Through the highly developed welding and cutting methods of the last few years, it is now possible to weld all the ordinarily used metals, including steel, cast iron, copper, brass, bronze, and aluminum. The stainless steels at first presented some difficulties, but they are now added to the number of metals and alloys that can be fabricated or repaired by welding. Welding rods are available today with characteristics that meet the requirements of practically every welding job, insuring weld strengths that were unobtainable only a few years ago.

Another great advantage of welding when used as a tool for making repairs and changes to prevent obsolescence is that major welding operations can frequently be made without removing a machine from its foundation; and parts of a machine can frequently be repaired or modernized without removing them from the machine. A specific example from the East Pittsburgh Works of the Westinghouse company may be mentioned, where a casting was repaired by welding in ten minutes. It would have taken 3 1/2 hours to remove the casting from the machine and assemble another in its place.

The comparatively recently developed bronze-

welding process has now reached the point where many important repairs can be made in place. Bronze-welding also makes it possible to build up worn parts quickly and economically to serve their original purpose. Any plant in the metal-working industries that fails to realize the economies obtainable by the proper application of welding and cutting in production, maintenance, and repair work is missing an important opportunity for economy of operation.

If it were possible to cut cast iron by the flame-cutting process as easily and efficiently as steel, great advantages could be gained both in maintenance and repair work to prevent obsolescence, and in the construction of new work. One of these days, presumably, some engineer will develop a truly efficient method for this purpose, and the flame-cutting and welding process will have taken another important step forward.

Hard-Facing Presents a Convenient Method of Making Repairs

Great strides have been made in the process of hard-facing. The hard-facing material may be applied either by the oxy-acetylene or the electric arc process to a surface that is ordinarily subjected to rapid wear. The economy of hard-facing has been so amply demonstrated that the practice of covering parts exposed to abrasion and wear with a layer of wear-resisting alloy has been accepted as standard procedure in many fields.

In the machine shop, the life of punches and dies is being greatly increased by this means. Dies that previously would have been scrapped may now be salvaged, built up, and hard-faced. The hard-faced dies will give even better service than new ones. Hot trimming dies for ring-gear forgings for automobile trucks, after hard-facing, were found to stand up eight times as long as the dies formerly used. The same results have been obtained by hard-facing the wearing surfaces of cams in cam-operated machines.

The Economy of Cutting and Welding in Jig and Fixture Construction

Jigs and fixtures used in machine building offer a most suitable field for welding. Here almost all of the advantages gained in using welding in machine construction are readily obtainable. In the first place, only one jig or fixture frame is ordinarily required, which means that a new pattern and a single casting made from it involve a very heavy cost. In every case, a welded jig or fixture frame can be made more cheaply. In some instances, from two to three weeks' time can also be saved in the making of large jigs by employing welded construction.

Furthermore, maintenance costs and obsolescence charges are greatly reduced. Jigs and fixtures frequently must be changed to meet a change in the design of the machine, in the making of which they are used. When welded construction is employed, such changes are readily made, and the jig continues its usefulness. If the jig is made from a casting, it almost always has to be scrapped when changes are made in the machine design, and a new pattern, a new casting, and a whole new jig has to be built. With welded construction, obsolete sections of the jig can be easily removed by flame-cutting, and new parts conveniently added by welding.

There is still another advantage derived from the use of welded jigs and fixtures. Because of the low cost of welded equipment, it is frequently economical to build jigs and fixtures for small-lot production, whereas with cast fixtures, the cost of the pattern and casting would make the fixture cost too high, unless the production were large enough to warrant the expense. Many of the larger concerns throughout the country who have made a careful study of welded jigs and fixtures have developed definite design methods and technique for the economical application of the welding process to this work.

The Opportunity of the Job Welding Shop

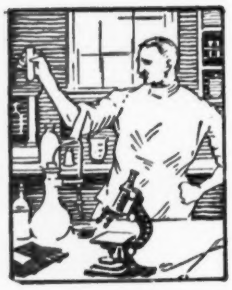
The welding jobbing shop can greatly increase its volume of work and its profits by being on the lookout for applications of welding and cutting that may never have occurred to the people for whom such work might be done. Obviously, the average manager or superintendent of a machine shop is less familiar with the flexibility of the welding process than are those who are directly engaged in doing welding and cutting work. In industrial centers especially, there is a great deal of maintenance work now being handled in other ways to which the welding and flame-cutting processes could be applied, placing machinery into a more up-to-date condition and deferring obsolescence. If the owner of a welding jobbing shop is able to make difficult repairs and to save equipment that could not be repaired by any other method, he will soon give his shop a reputation for exceptional work.

As a rule, most of the maintenance work that can be successfully done by welding will not come to the welding shop unsolicited. It is for the shop to point out the advantages and savings that can be made by welding and to bring in work that would not have been brought to the shop without solicitation. The jobbing shop can do much to make manufacturers welding-minded, so that welding, instead of being the last method thought of, will be the first to be given consideration.

* * *

The open type of passenger car is almost a thing of the past. At the present time, only one out of every two hundred passenger cars built in this country is an open model, or 1/2 per cent of the total production.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Hard Facing Increases the Life of Welder Jaws

Steel jaws used for holding two pieces of metal to be welded in an electric flash welding machine are subjected to severe operating conditions. They are first clamped on the work and then a heavy current is applied through them to the parts to be welded. The full discharge of the welding current through the jaws produces considerable heat. While the jaw surfaces are still hot, the finished work is quickly released.

A manufacturer who employs flash welding in the production of steel pipe couplings found that when such jaws were rebuilt by oxy-acetylene welding a layer of Haynes Stellite to their faces, they lasted ten times as long as when they were new. This long life is due to the fact that Haynes Stellite retains its initial hardness even at red heat. Rebuilt surfaces that are worn off the welding jaws are rebuilt again.

Wearing Qualities of Alloy Cast Iron

An interesting experience with nickel cast iron for machine tools was recently recorded by the *Nickel Cast Iron News*. At the plant of the Mattison Machine Works, Rockford, Ill., a surface grinder built by the company for its own use six years previously was dismantled and thoroughly inspected to determine where wear had taken place. The machine had been used almost continuously on jobbing work during the six years mentioned. The nickel cast iron parts, according to the inspectors, had not worn enough to be susceptible to measurement and were apparently the same as when installed. In particular, it was mentioned that the "spotting" on the ways of the machine at the time of assembling was practically unchanged in appearance.

The composition of this nickel cast iron is approximately as follows: Total carbon, from 3 to 3.25 per cent; silicon, from 1.30 to 1.50 per cent; manganese, from 0.60 to 0.80 per cent; nickel, from 1.25 to 1.50 per cent; and chromium, from 0.30 to 0.40 per cent. About 40 per cent steel is used in the mixture. The Brinell hardness of this alloy iron runs from 210 to 220. It is readily machineable. The wear resistance is better than this hardness figure would indicate, due to the close-grained uniform structure with no large graphite areas.

Amaloy—a Protective Coating for Steel, Brass, or Copper

A hot dipping process known as "Amaloy" has been developed by the American Machine & Foundry Co., 511 Fifth Ave., New York City, for coating a solid solution of lead on various base metals. It will provide a permanent protective coating on forged, drawn, or rolled steel, brass, and copper. The process is said to establish a firm bond between the applied lead and the base metal, so that the lead will not break or flake from its metal foundation. Bolts and nuts can be coated without the necessity of recutting the threads.

The process is applicable to a wide range of products, especially parts that are to be exposed to the weather or to marine conditions. Amaloy is also being used to provide lubrication in wire drawing operations.

Brazing Alloy Made of Phosphorus and Copper

An alloy of phosphorus and copper, known as Phos-Copper, has been developed by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., for use in place of expensive silver solders. This alloy melts at approximately 1300 degrees F., a temperature that can easily be obtained with the oxy-acetylene torch or a carbon arc. The alloy possesses a high tensile strength and excellent penetration, and is therefore suitable for applications where strength or gas- and liquid-tight joints are required. It is being used on refrigerator parts where leak-proof joints are a prime necessity.

Other desirable properties of Phos-Copper include self-fluxing for most applications, high ductility, high resistance to fatigue and corrosion, high electrical conductivity, and unusual fluidity at the brazing temperature. Standard rods of the alloy range from 1/16 to 1/4 inch in diameter, and they are 3 feet long. Ribbon 0.015 inch thick by 1 1/4 inches wide is available, as well as washers and other shapes.

Pumps Made of Worthite Resist Sulphuric Acid

All parts in the liquid handling end of a line of centrifugal pumps manufactured especially by the Worthington Pump & Machinery Corporation, Harrison, N. J., for handling various acids are made of Worthite. This is a high-nickel, high-chromium molybdenum steel alloy with a maximum carbon content of only 0.07 per cent. The alloy can be used for all purposes where chromium-iron alloy or nickel-chromium stainless steels are suitable, and in addition, it is highly resistant to sulphuric acid.

The alloy has a tensile strength ranging from 67,000 to 75,000 pounds per square inch, and a yield point ranging from 30,000 to 35,000 pounds per square inch. The elongation in 2 inches is from 35 to 45 per cent, and the reduction in area is from 35 to 45 per cent. The hardness ranges from 125 to 150 Brinell. These properties are similar to those of cast 18-8S alloy, but Worthite is somewhat harder and offers greater resistance to wear.

A New Thermo-Plastic Resin Available in Cast Shapes and Powder

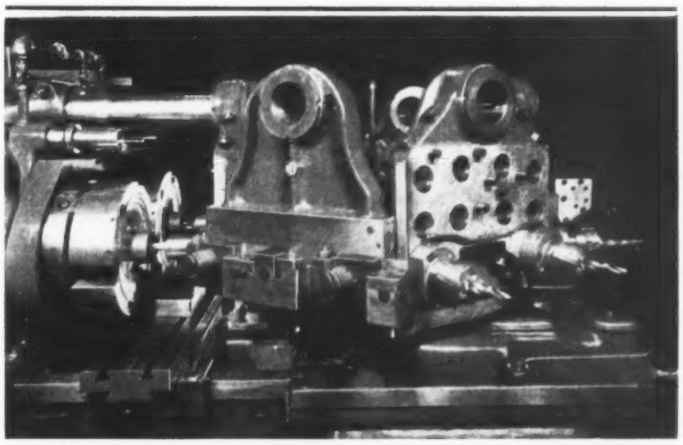
"Pontalite" is the name given to a thermo-plastic resin being introduced on the market by E. I. du Pont de Nemours & Co., Inc., 350 Fifth Ave., New York City. This resin will be sold in the form of cast sheets, rods, and tubes, and also as a molding powder. In both forms, it will be available as a crystal-clear product and in a wide variety of transparent, translucent, and opaque colors.

Pontalite has a tensile strength of from 8000 to 10,000 pounds per square inch, and a transverse (flexural) strength of from 12,000 to 14,000 pounds per square inch. It is unaffected by water solutions of mineral salts or alkalies, and is resistant to concentrated hydrochloric acid and 50 per cent sulphuric acid at room temperature. The material can be readily machined on lathes and automatic screw machines, and it can be readily formed, swaged, and drilled. For forming and swaging, the material should be heated on a steam plate or immersed in water at a temperature of about 200 degrees F.

Aluminum Turret and Tool-Holders Increase Machine's Capacity

Aluminum was recently applied in solving the problem when a manufacturer required a six-face turret on a Potter & Johnston turret lathe ordinarily built with a cast-iron turret having five faces. The special turret had to be made with faces of the same length as on the cast-iron turret ordinarily supplied for this machine, which has a weight of 750 pounds in the rough. It was estimated that a six-face turret made from cast iron would weigh approximately 950 pounds. Also, with six faces, the distance from the center of the turret to each face was increased 3 inches.

In order to avoid a greatly increased inertia from a heavier and larger turret, it was decided to construct the turret and its tool-holders and auxiliary slide tools from aluminum. The turret and tool-holders, which are shown in the accompanying illustration, were subsequently cast from a heat-treated aluminum alloy that possesses a tensile strength of 36,000 pounds per square inch and a yield strength of 22,000 pounds per square inch. The turret is of hollow design and is ribbed on the inside for strength and rigidity. In the rough, the turret casting weighed only 373 pounds, and the tool-holders 100 pounds. The tool-holders weigh about twice this amount when made of cast iron.



Turret and Tool-holders Cast from an Aluminum Alloy Made a Substantial Weight Reduction Possible when a Larger Six-face Turret was Required on a Turret Lathe Ordinarily Supplied with a Five-face Turret

NEW TRADE  LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.

Drilling and Tapping Machines

EDLUND MACHINERY CO., INC., Cortland, N. Y. Bulletins 100, 101, 102, 103, and 104, containing complete information, including general descriptions and specifications, covering, respectively, Edlund motor-driven drill units, which are designed for drilling holes at an angle or for drilling two or more holes in different planes; No. 2B high-speed ball-bearing sensitive drilling and tapping machines, which are made with from one to eight spindles; No. 0 drilling and tapping machines designed for rapid but low-cost drilling and tapping; Nos. 4B and 1A production drilling and tapping machines; and built-in motor drilling and tapping unit for application either to standard or special machines.

Cemented-Carbide Tools

CARBOLOY CO., INC., 2987 E. Jefferson Ave., Detroit, Mich., has published a grinding manual, GM-36, showing the latest technique for the rapid and economical grinding of Carboloy tools. The manual gives information on grinding machine requirements, recommended grinding wheels, how to rough-grind on the periphery of straight wheels, how to dress the wheels, recommended method for rapid rough-stock removal, and procedure for using diamond wheels and lapping disks. Directions are also given for grinding Carboloy tools that are chipped or dull, milled and brazed, as well as for changing the shapes of tools.

Zinc Alloy Die-Castings

NEW JERSEY ZINC CO., 160 Front St., New York City. Publication entitled "Supplement to a Visual Report of Progress," describing the astounding progress which has been made in the die-casting industry since last year, when the original "Visual Report of Progress" was published. The book shows many examples of zinc-alloy die-castings that should be of suggestive value to designers and aid them in developing future designs.

Indicating and Recording Instruments

BROWN INSTRUMENT CO., a Division of the Minneapolis-Honeywell Regulator Co., 4485 Wayne Ave., Philadelphia, Pa. Circular entitled "Here's the Answer to Your Temperature Problem," devoted to Brown thermometer controllers for precise control of industrial processes where temperature plays an important part. The circular also describes "Con-Tac-Tor" mercury switches.

Milling Machines

SUNDSTRAND MACHINE TOOL CO., 2530 Eleventh St., Rockford, Ill. Bulletin 2 EL, containing detailed information on the construction and operation of the Sundstrand automatic No. 2 Electromil, an electrically controlled Rigidmil for high-speed economical operation on small workpieces. Complete specifications are included for the 18- and 24-inch sizes.

Electric Motors

WAGNER ELECTRIC CORPORATION, 6467 Plymouth Ave., St. Louis, Mo. Bulletin S 480, illustrating and describing Wagner totally enclosed motors for machine tools. Bulletin 177, descriptive of fractional-horsepower gear-motors of from 1/6 to 3/4 horsepower. Bulletin 182, containing data on polyphase squirrel-cage and slip-ring motors.

Manganese Steel Products

MANGANESE STEEL FORGE CO., Richmond St. and Castor Ave., Philadelphia, Pa. Bulletin R-1, entitled "Index of Applications," listing some of the many different applications of Rol-Man manganese steel, which is available in the form of forgings, pressings, plate products, wire products, threaded bolts, bars and shapes, and welding rod.

Haynes Stellite Burnishing Rollers

HAYNES STELLITE CO., Unit of Union Carbide and Carbon Corporation, Kokomo, Ind. Illustrated folder on Haynes Stellite burnishing rollers, describing the advantages of burnishing railroad car axle journals, locomotive driving axle journals, piston-rods, crankpins, etc., with Haynes Stellite rollers.

Lubricants and Cutting Alloys

E. F. HOUGHTON & CO., 240 W. Somerset St., Philadelphia, Pa. Booklet entitled "Metal-Working Products by Houghton," briefly describing the line of rust preventives, cutting oils, metal cleaners, liquid baths, quenching oils, carburizers, pickling inhibitors, lubricants, and steel drawing compounds made by this company.

Graphite-Bronze Bearings

RANDALL GRAPHITE PRODUCTS CORPORATION, 609 W. Lake St., Chicago, Ill. Catalogue on Randall graphite-bronze bearings, provided with a marginal thumb-index of standard sizes for convenient reference. The catalogue lists outside and inside diameters and lengths of all standard graphite-bronze bushings and sheave bearings.

Ball and Roller Bearings

WESTERN BEARINGS CO., 3012 Calumet Ave., Chicago, Ill. New set of engineering bulletins pertaining to standard and special ball and roller bearings from 1/2 inch to 36 inches shaft size. In addition to general specifications, tables of load-carrying capacities are given, and various applications are recommended.

Pumps and Air Compressors

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J.

Bulletin W-323-B1A, descriptive of Worthington electrically operated centrifugal pumps arranged for automatic priming. Bulletin L-611-B2A, entitled "Compressed Air at Lower Cost," describing Worthington feather valve compressors.

Turret Lathes

JONES & LAMSON MACHINE CO., Springfield, Vt. Circular entitled "A Turret Lathe for Every Purpose and for Every Purse," illustrating ten different styles of the Jones & Lamson line of turret lathes ranging from 1 1/2-inch to 4-inch bar capacity and 10- to 18-inch chucking capacity.

Taps

UNION TWIST DRILL CO., Butterfield Division, Derby Line, Vt. Circular containing information on the correct tap to use in tapping Bakelite; brass, bronze, and copper; cast iron; tool steel; cold-rolled and low-carbon alloy steels; and stainless steel. Data is also given on lubrication.

Carboloy Tools

CARBOLOY CO., INC., 2987 E. Jefferson Ave., Detroit, Mich. New eight-page price list on Carboloy standard tools and blanks, containing reduced prices effective October 1. Copies of the price list, together with catalogue M-32-R, listing complete specifications of all standard Carboloy tools, are available.

Power Transmission Equipment

BOSTON GEAR WORKS, INC., North Quincy, Mass. Catalogue 51, listing the line of power transmission equipment made by this company, including ball bearings, gears and pinions, bushings, chain and sprockets, couplings, pillow blocks, pulleys, ratiomotors, ball bearings, variable-speed transmission, etc.

Drop-Forgings

CHAMBERSBURG ENGINEERING CO., Chambersburg, Pa. Pamphlet entitled "Developments in Modern Drop-Forging," containing a paper presented by R. E. W. Harrison, vice-president of the Chambersburg Engineering Co., before the Detroit Chapter of the American Society of Tool Engineers.

Broaching Machines

COLONIAL BROACH CO., Detroit, Mich. Bulletin 104-9E, illustrating and describing Colonial Utility presses for medium-duty broaching and press work. Bulletin 104-9G, descriptive of Colonial heavy-duty "Pullup" broaching machines for automatic heavy-duty pull broaching.

Non-Ferrous Nickel Alloys

INTERNATIONAL NICKEL CO., INC., 67 Wall St., New York City. Booklet containing information on the properties and applications of Monel and other non-ferrous nickel alloys in the engineering fields, including the automobile, refrigeration, hydroelectric and many other industries.

Precision Lathes

SOUTH BEND LATHE WORKS, 770 E. Madison St., South Bend, Ind. Catalogue announcing the new South Bend 1937 model 9-inch work-shop precision lathe. Over 150 illustrations show the many new styles, features, and applications of this new back-geared screw-cutting lathe.

New and Used Machinery

J. L. LUCAS & SON, INC., Bridgeport, Conn. Circular announcing new Loshbough & Jordan open-back inclinable presses. Circular listing portable air compressors and spray equipment, tote pans, Excelsior geared-feed drill, portable saws and drills, Manville power presses, etc.

Drop-Forgings

KROPP FORGE CO., 5301 W. Roosevelt Road, Chicago, Ill. Folder illustrating and describing this company's facilities for making drop-forgings and die-blocks and for heat-treating and machining. The circular also shows a wide variety of parts produced by drop-forging.

Rubber Machinery Mountings

B. F. GOODRICH CO., Mechanical Rubber Goods Division, Akron, Ohio. Bulletin describing the Goodrich line of rubber-to-metal mountings, known as Vibro-Insulators, which are designed for application on mechanical equipment to absorb shock and vibration and to reduce noise.

Clutches and Couplings

HILLIARD CORPORATION, Elmira, N. Y. Catalogue covering the Hilliard line of clutches and couplings, which includes friction clutches, over-running clutches, ball-bearing sleeve clutches, single-revolution clutches, and combinations of the different types.

Welding Machines

HARNISCHFEGER CORPORATION, 4536 W. National Ave., Milwaukee, Wis. Bulletin W-8, illustrating and describing the new line of P & H-Hansen Smootharc welders, which are available in a wide range of sizes and in both vertical and horizontal mountings.

Electric Control Equipment

ALLEN-BRADLEY CO., 1331 S. First St., Milwaukee, Wis. Circular descriptive of Bulletin 709, "Across-the-Line" solenoid motor starters, which are made in two styles—with enclosing cabinet for general use, and without cabinet for built-in jobs.

Engine Lathes

LODGE & SHIPLEY MACHINE TOOL CO., Cincinnati, Ohio. Folder illustrating and describing the Lodge & Shipley line of triple-geared, selective-head engine lathes which are made in 36- and 42-inch sizes. Complete specifications are included.

Wire and Cables

ANACONDA WIRE & CABLE CO., 25 Broadway, New York City. Publication C-34, containing instructions for making a wiring survey to determine the condition of the electrical equipment and wiring in industrial plants.

Ovens and Heaters

GEHNRICH CORPORATION, Skillman Ave. and 35th St., Long Island City, N. Y. Bulletins 102 and 103, covering this company's line of ovens, dryers, and air heaters for industrial baking, drying, and heat-treating operations.

Electric Motors

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa. Leaflet 20652, describing the new and improved design of Westinghouse explosion-tested, fan-cooled, completely enclosed, Type SK direct-current motors.

Rotary Converters

JANETTE MFG. CO., 556 W. Monroe St., Chicago, Ill. Bulletin 13-1, illustrating and describing Janette rotary converters for converting direct current to alternating current for use with radios, testing equipment, X-ray equipment, etc.

Screwdrivers

R. G. HASKINS CO., 4634 W. Fulton St., Chicago, Ill. Bulletin 54-S,

entitled "The Haskins Method of Setting Screws and Nuts." Seven different types of power screwdrivers are illustrated and described.

Crankpin Grinders

LANDIS TOOL Co., Waynesboro, Pa. Catalogue N-36, containing complete data on the details of design, operation, and advantages of Landis 16-inch Type D hydraulic crankpin grinders. The construction is clearly shown by close-up views.

Abrasives

NORTON Co., Worcester, Mass. Booklet entitled "Norton Abrasives for the Lapidary," containing a condensed study of abrasive wheels, as well as polishing and buffing powders, used in lapidary work.

Welding Equipment

LINCOLN ELECTRIC Co., Cleveland, Ohio. Bulletin 314, containing specifications covering the Lincoln Model SA 150 welding machine. The circular shows various typical applications.

Gases for Welding and Cutting

AIR REDUCTION SALES Co., 60 E. 42nd St., New York City. Booklet on Airco acetylene for welding and cutting. The comparative consumption of oxygen by various fuel gases is shown diagrammatically.

Precision Gage-Blocks

FORD MOTOR Co., 3674 Schaefer Road, Dearborn, Mich. Folder 7540, descriptive of the No. 16 set of Johansson gage-blocks, as well as sine bars and straightedges for use with these gage-blocks.

Speed Reducers

WESTINGHOUSE ELECTRIC & MFG. Co., East Pittsburgh, Pa. Bulletin 25-030, on Types SH and DH single- and double-reduction speed reducers for application in general industrial and mining operations.

Cleaning Equipment

PANGBORN CORPORATION, Hagerstown, Md. Bulletin 201a, illustrating and describing the Pangborn Type RA-2 Rotoblast cleaning unit for cleaning castings, forgings, steel products, etc.

Drilling Machines

BUFFALO FORGE Co., Buffalo, N. Y. Bulletin 2730-C, illustrating and describing in detail Buffalo No. 16 sensitive drilling machines, which are made with from one to six spindles.

Circuit-Breakers

GENERAL ELECTRIC Co., Schenectady, N. Y. Bulletin GEA-2450, descriptive of Type AE-1 air circuit-breakers for industrial and central station auxiliary service.

Steam Turbines

ALLIS-CHALMERS MFG. Co., Milwaukee, Wis. Bulletin 1181, covering the line of high-pressure non-condensing steam turbine units made by this concern.

Cam Milling Machines

ROWBOTTOM MACHINE Co., Waterbury, Conn. Catalogue illustrating and describing the new Model 325 Rowbottom universal cam milling machine.

Rebuilt Machine Tools

EASTERN MACHINERY Co., 3267 Spring Grove Ave., Cincinnati, Ohio. List No. 37 of rebuilt machine tools, classified according to types and including prices.

Pneumatic Equipment

C. A. NORGREN Co., INC., Denver, Colo. Catalogue covering Norgren pneumatic products, including sight-feed automatic lubricators, valves, hose, chucks, couplings, etc.

Electric Trucks

ELWELL-PARKER ELECTRIC Co., Cleveland, Ohio. Bulletin A-7512, describing Elwell-Parker high-lift platform trucks, and showing typical applications.

Industrial Trucks

LEWIS-SHEPARD Co., 175 Walnut St., Watertown, Mass. Folder 225, illustrating the latest designs of industrial floor trucks made by this company.

Inclinable Power Presses

E. W. BLISS Co., 1420 Hastings St., Toledo, Ohio. Bulletin 198, illustrating and describing the Bliss line of inclinable open-back power presses.

Tools and Wrenches

BONNEY FORGE & TOOL WORKS, Allentown, Pa. Catalogue 37-M containing data on the Bonney line of industrial wrenches and tools.

Blueprinting Machines

C. F. PEASE Co., 813 N. Franklin St., Chicago, Ill. Circular illustrating and describing the new Pease Model 27 blueprinting machine.

Temperature Control Equipment

BURLING INSTRUMENT Co., 241 Springfield Ave., Newark, N. J. Circular descriptive of Burling automatic temperature controls.

Oil Seals

NATIONAL MOTOR BEARING Co., INC., 1200 78th Ave., Oakland, Calif. Bulletin on oil and fluid seals for protecting shaft bearings.

Foundry Core Oils

SWAN-FINCH OIL CORPORATION, New York City. Circular on Safco core oils for foundry work.

* * *

Industrial Machinery Exports Show Marked Increase

Foreign sales of industrial machinery for the first ten months of this year exceed the full year's exports of any year since 1930. The exports of industrial machinery in October increased to over $16,000,000, the highest monthly volume since June, 1931. The exports of power-driven metal-working machinery amounted to $3,883,000, as compared with $3,276,000 in September. In the October exports, lathes accounted for $538,500; vertical boring mills, $384,000; thread-cutting and automatic screw machines, $323,600; vertical drilling machines, $72,000; cylindrical grinding machines, $104,000; and forging equipment, $127,000. The ten months' total value for industrial machinery exports this year aggregates slightly over $140,000,000, which is $18,600,000 more than the exports during the entire last year.

* * *

Steel Balls of Extreme Accuracy

F. K.—The writer would like to know if there is any source of supply from which steel balls or spheres might be obtained having limits on the diameter of plus or minus 0.00002 inch, and having no measurable out-of-roundness tolerance. [This question is submitted to MACHINERY'S readers.]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

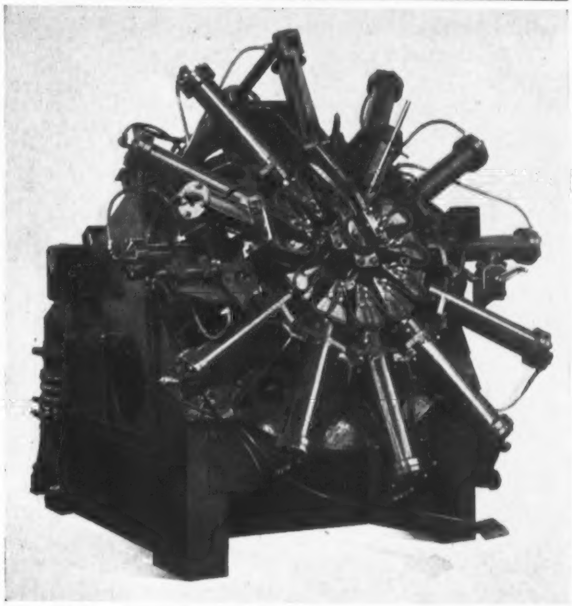


Fig. 1. Welding Machine of Radial Design which Makes Forty-eight Welds in Ten Seconds

Federal "Oil Spot" Projection Welder with Rotary Hydraulic Control

Twelve hydraulically operated welding heads are positioned radially about the work-holding fixture on a projection type of welding machine recently built by the Federal Machine & Welder Co., Warren, Ohio. The operation performed by this machine consists of progressively welding a finned stamping, such as seen at the right in Fig. 2, to a housing or shell of the type seen in the middle, so as to produce a rotary motor housing for electrical refrigerators, as shown in the finished state at the left of the illustration.

Four projection welds are made between each fin in order to attach the finned stamping to the housing. The housing is made of steel 1/8 inch thick, and the finned stamping of No. 16 gage steel. The over-all diameter of the finished piece is approximately 8 inches.

At the beginning of the operation, the housing is seated on an Elkonite-faced locating electrode, and the finned stamping is slipped over the housing with the split ends in line with an air-operated clamping device. When a valve is opened to operate this clamp, the split ends of the finned stamping are pulled together and a second clamp descends on top of the work pieces to hold them in place.

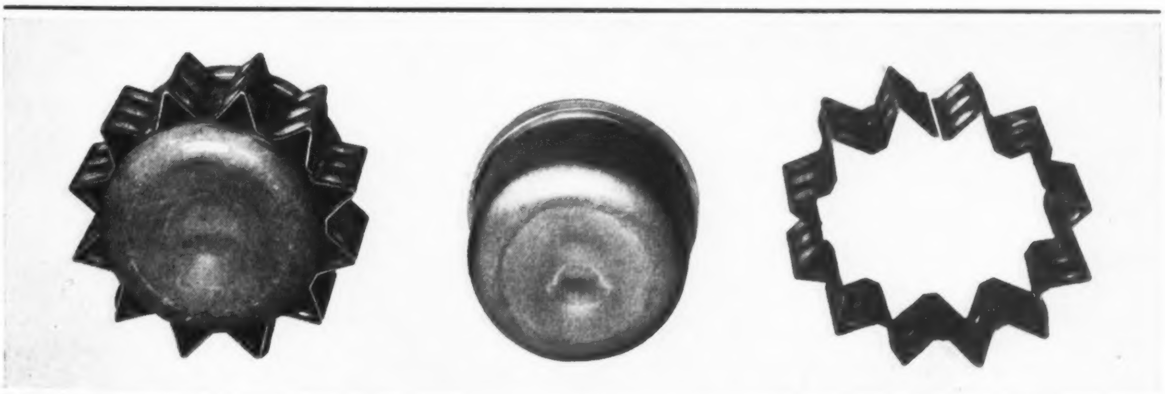


Fig. 2. Completely Welded Refrigerator Motor Housing (at Left) and Two Stampings from which it is Fabricated

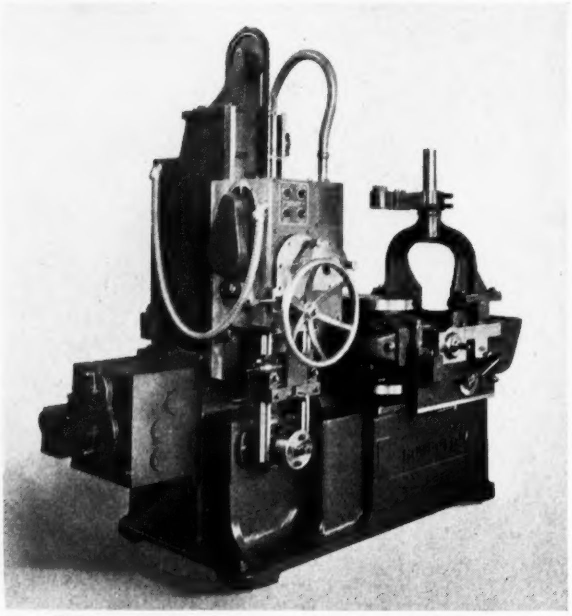


Fig. 1. Rowbottom Combination Cam Milling and Grinding Machine Set up for an Operation on Drum or Side Cams

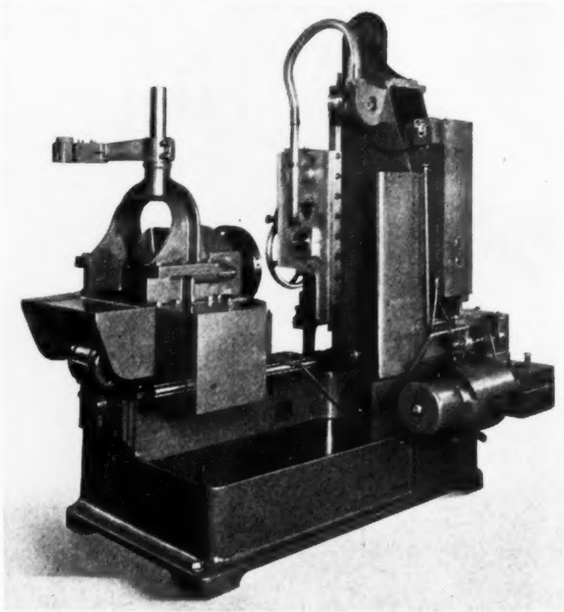


Fig. 2. Rear View of the Machine, with the Work-head Horizontal, as in Milling or Grinding Box or Face Cams

By depressing a push-button, the twelve hydraulically operated rams of the radial welding heads are actuated in sequence to make a total of forty-eight projection welds. The time for completely welding each piece is only 10 seconds. At the end of the operation, the foot-lever is depressed for ejecting the finished part.

The successive operation of the welding electrodes is controlled by means of a motor-driven rotary hydraulic valve which has twelve ports. The welding current is controlled by individual cams provided for each head, these cams being located around the periphery of the valve. The cams operate a quick-setting limit switch, which, in turn, controls a high-speed contactor.

With the hydraulic system operating at a pressure of 500 pounds per square inch, the force supplied to each welding ram for the operation is approximately 2300 pounds. However, this pressure can be varied on the individual welding heads, if desired. The weight of this equipment is approximately 6200 pounds. The machine occupies a floor space of 76 by 68 inches. It is 72 inches high.

Rowbottom Combination Cam Milling and Grinding Machine

Important improvements have been incorporated in a Model 325 machine now being placed on the market by the Rowbottom Machine Co., Waterbury, Conn., for milling and grinding various types of cams. For grinding operations, an attachment is simply mounted above the cutter-spindle and power is obtained from the cutter-spindle motor instead of from a separate motor as on previous machines built by the same concern. The work-head is of a trunnion design that may be indexed on its axis to position the work-spindle either horizontally or vertically. This feature adapts the machine to the production of both drum and face cams. Fig. 1 shows the machine set up for an operation on drum cams, while Fig. 2 shows the work-head in the horizontal position for cutting box or face cams.

Separate motors are provided for the feed and cutter drives. They are interlocked electrically. The cutter-spindle motor is mounted in a head cast from aluminum alloy. Reversal of these drives is effected electrically through the motors, rather than mechanically as on previous machines. There is a rapid traverse for the work-head, whereas on previous machines there was simply a hand adjustment provided for bringing the work up to the cutter.

Four motors drive the machine, a two-horsepower motor for the cutter-spindle, a one-horsepower brake motor for the work-head, a 1/2-horsepower motor for the work-head rapid traverse, and a 1/6-horsepower motor for the blower which supplies air for cooling the cutter and keeping it free from chips.

Eight speeds from 66 to 500 revolutions per minute are available for the Timken-mounted cutter-spindle. Speed changes are effected through sliding gears on spline shafts, which run in a bath of oil. Eight work-spindle speeds ranging from 1 revolution in 30 minutes to 1 revolution in 2 1/2 minutes are available with a slow setting of the work-head gears, and eight speeds nine times faster can be obtained with a fast setting of the gears.

Although this machine is the same size as the Model 300 described in September, 1931, MACHINERY, the capacity for box and face cams has been increased from 28 to 32 inches diameter, and the capacity for drum cams from 24 to 30 inches.

Oilgear Propeller Twisting Machine

Airplane propeller blades ranging from 6 inches wide by 1 inch thick up to 14 inches wide by 4 inches thick can be twisted to the desired shape by means of a hydraulic machine recently designed by the Oilgear Co., 1310 W. Bruce St., Milwaukee, Wis. This machine accurately twists the propeller blades to the pitch required at the various sections. Three large screws in stationary clamps positioned on each side of a twister arm and a similar number of screws on the twister arm itself are adjusted to suit the contour of the propeller and to hold it firmly in place until the twisting operation has been completed.

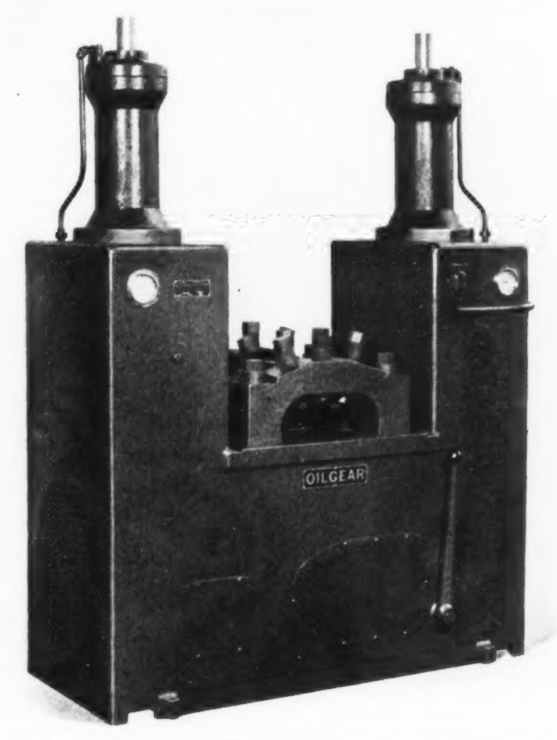
The floating twister arm is supported at the center of the machine frame in the normal starting position by means of two cage springs, one on each end. In operation, two vertical non-differential hydraulically interlocked cylinders apply an equal force to each end of the twister arm. The pump, electric motor, piping, control and operating mechanism are enclosed in the all-steel welded frame.

At the beginning of an operation, the propeller blade is fed into the stationary clamp and the twister arm to the point to be twisted, after which the propeller blade is clamped in either one of the stationary clamps and in the twister arm. Then the control lever is actuated to effect the twisting operation. With the two-way variable delivery pump provided, the twisting action can be stopped or reversed at any point in the machine cycle.

Michigan Duplex Gear Finisher

A gear finishing machine just developed by the Michigan Tool Co., 7171 E. McNichols Road, Detroit, Mich., is designed to meet the requirements of manufacturers who do not have sufficiently long production runs to take full advantage of the Michigan rack type gear finisher. In the new machine, the gears to be finished are mounted between centers and are fed toward the rear of the machine between two crossed-axis cutters, which may be seen in Fig. 2.

A feature of this machine is that the two cutters can be used independently to finish simultaneously two gears of different characteristics in a cluster, or both the right- and left-hand sides of a herringbone gear. This eliminates the necessity of using duplicate machines in such



Oilgear Hydraulically Operated Machine Built for Twisting Airplane Propeller Blades

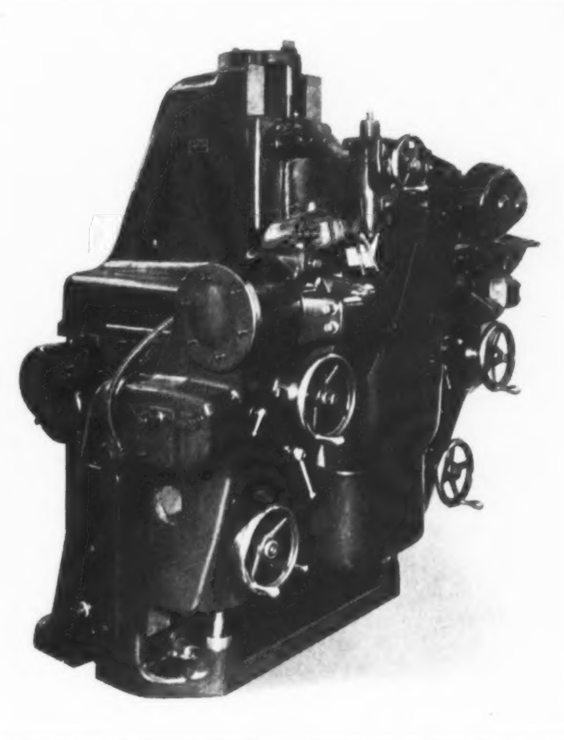


Fig. 1. Michigan Gear Finisher Intended for Handling a Variety of Gears in Small Quantities

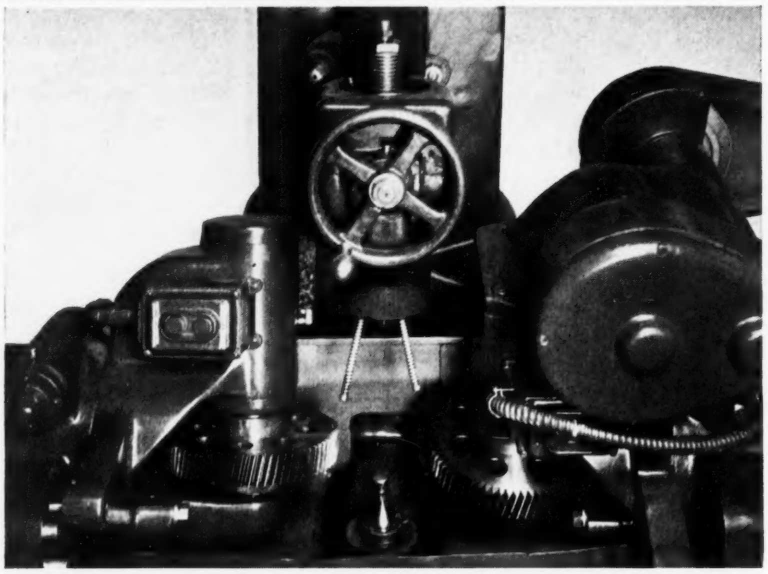


Fig. 2. Two Cutters on Opposite Sides of the Gear Finish its Teeth as it is Fed between Them

operations, and reduces loading and cutting time one-half. This advantage has been made possible by making the two cutters separately adjustable for height, for position with reference to the axis of the gears, and for crossed-axis setting.

In Fig. 2, the cutters are positioned for finishing a single helical gear. Adjustments for obtaining the correct location of the cutter axes are made by means of the two handwheels that may be seen to the right and left of the work in Fig. 1, while adjustments for height are made through the two handwheels seen below the other two. Adjustment of the crossed-axis setting is made by means of worm-gearing in the cutter-heads.

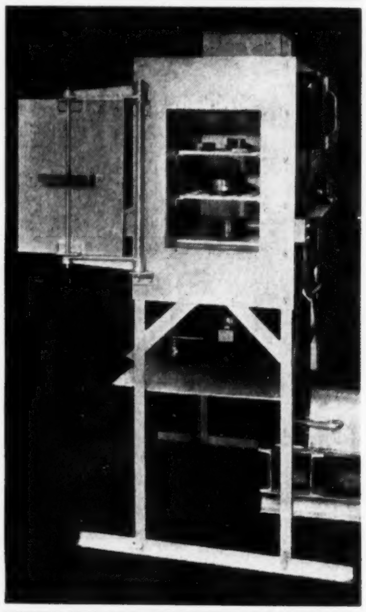
The crossed-axis setting of the cutters creates a sliding action lengthwise of the teeth as the cutters and work are rotated with their teeth in mesh. At the time of loading the work into the machine, the centers are in front of the cutters. The gear is finished to size at the time that its center has been fed into line with the centers of the cutters. The speed of the working and return strokes of the work slide can be varied by changing pick-off gears.

Lindberg Tool-room Furnace

A tempering furnace designed specifically for tool-room service has been added to the Cyclone line of the Lindberg Engineering Co., 224 Union Park Court, Chicago, Ill. Although this furnace operates on the same principle as the standard furnaces of the line, it is not a production furnace; it is a box type unit recommended for use when the work is charged and removed piece by piece.

Air is driven by a blower fan through the electric heating elements and into the top of the work chamber. The air passes down through the charge and returns to the fan through a perforated bottom plate.

Several shelves are provided in the work chamber to hold small parts for tempering. These shelves can be removed when large parts are to be treated. The furnace door is so hinged that it can be readily withdrawn and swung away from the opening, with the hot face of the door always away from the operator. Box type furnaces of this kind are made in several sizes for use at temperatures up to either 800 or 1200 degrees F.



Lindberg Furnace for Economical Tempering of Individual Pieces

Delta 17-Inch Drilling Machines

Seventeen-inch floor and bench type drilling machines designed for the general machine shop, tool-room, and production shop

Delta Drilling Machine of Improved Construction

have been brought out by the Delta Mfg. Co., 630 E. Vienna Ave., Milwaukee, Wis. The floor type model may be equipped with either an 11- by 12-inch tilting table or a 12 1/2- by 17-inch production type table. The column is made of 3 1/2-inch heavy-walled tubing which is ground and polished. These machines have a capacity for drilling up to 3/4 inch in cast iron.

An extra large spindle pulley provides five speeds of 385, 600, 935, 1450, and 2240 revolutions per minute. It is carried in two self-sealed New Departure ball bearings. The pulley is of the floating type, which does not transmit belt pull or stresses to the spindle. The spindle also is carried in two self-sealed New Departure ball bearings at the lower end of the quill.

A built-in foot-feed is available for these machines. Another feature is that the heads can be used as units to build up special machines. It is possible to operate a number of the heads together by linking their foot-feeds to a common lever.

Hannifin Hydraulic Straightening and Multiple-Platen Presses

A 20-ton hydraulic press especially designed for the accurate straightening of camshafts, axle-shafts, and similar parts is a recent development of the Hannifin Mfg. Co., 621-631 S. Kolmar Ave., Chicago, Ill. Simplified straightening and increased production are features of this press resulting from the design of the control mechanism. This machine is shown in Fig. 1.

A single lever controls the entire operation of the ram. When this lever is moved in either direction, the ram will move a proportional distance and then stop by automatically bringing the operating valve into its neutral setting. Thus the operator can obtain a ram movement at a pressure of 20 tons through the exact distance required for straightening any piece.

Very short and accurate ram movements either up or down can also be obtained. The arc of the control lever movement is several times that of the ram stroke, thus providing an unusually sensitive control without requiring special skill on the part of the operator.

The hydraulic power unit includes a constant-delivery rotary pump which is built into the base, thus making a self-contained unit requiring minimum floor space. Both the ram and the table may be fitted with any type of fixture required. The machine has a stroke of 6 inches. Power strokes are at a speed of 69 inches a minute, and return strokes at a speed of 96 inches a minute. The distance between the table and the ram when the latter is in its up position is 8 1/2 inches, and the distance from the center of the ram to the frame is 7 1/2 inches.

An 80-ton hydraulic press equipped with a multiple number of platens is illustrated in Fig. 2. This machine was built by the same concern for the high-pressure testing of refrigerator-body tanks. These tanks vary in size and thickness and must be protected against deformation at the top and bottom due to the interior pressures applied in testing. Each platen is individually controlled by a single lever. The cycle of operations is automatically provided by a two-

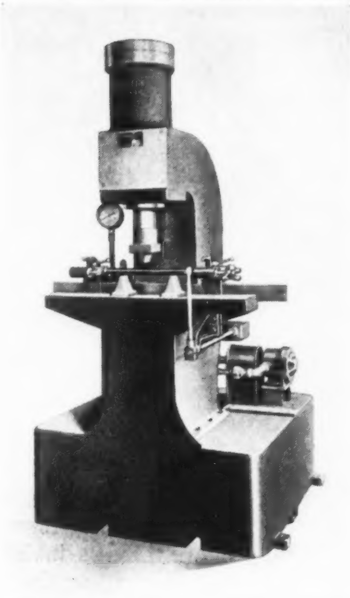


Fig. 1. Hannifin 20-ton Hydraulic Straightening Press

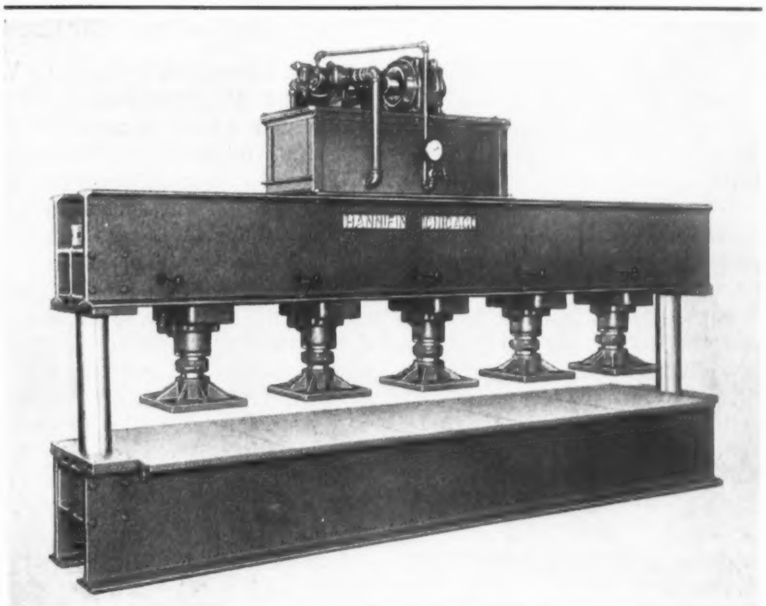
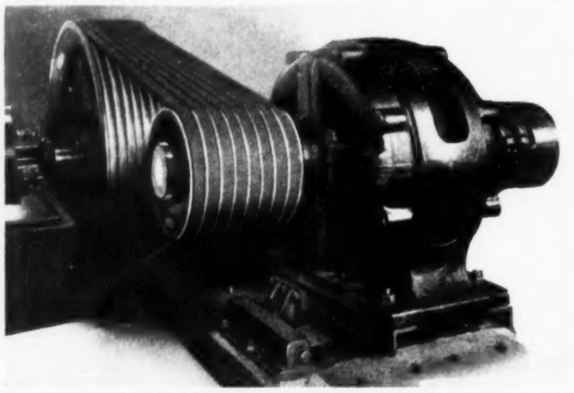


Fig. 2. Hydraulic Press with Five Individually Controlled Platens

pump hydraulic power unit and a special valve unit. There is a rapid advance stroke until each platen touches the tank to be tested, after which the larger volume pump is by-passed, so that it idles at no load. The high-pressure pump then provides the predetermined holding pressure for automatically maintaining the platen in contact with the top of the tank, regardless of the testing pressure applied to the interior of the tank.

Rockwood V-Belt Drives with Pivoted Motor Bases

The Rockwood Mfg. Co., 1801-2001 English Ave., Indianapolis, Ind., has brought out a line of V-belt drives equipped with the pivoted motor bases made by this concern. Cast-iron or steel illustration shows a drive provided with a standard floor-mounting base. Drives can be supplied with a vertical base, and there is also a ceiling base for overhead drives.



Rockwood V-belt Drive Equipped with Horizontal Floor-mounting Base

sheaves and rubber V-belts can be supplied.

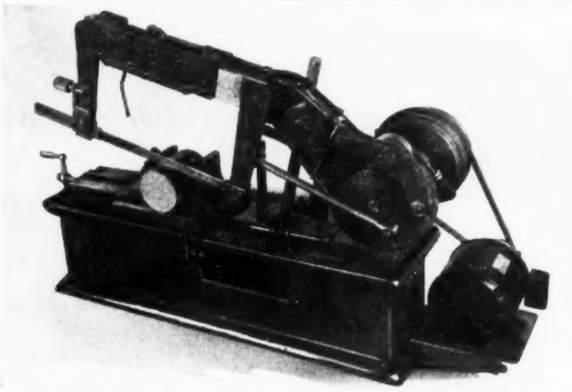
The pivoted motor bases are designed to improve V-belt performance by maintaining a constant ten ion in the belts. They automatically take up any belt stretch, and therefore eliminate belt slip, with its resultant fast wear and reduced efficiency.

Another advantage claimed for these drives is that the tension is removed from the belts when the drive is not running, so that the belt life is prolonged considerably. The bases can be purchased separately for use with existing V-belt drives, if desired. A base can be simply installed by raising the motor of the existing installation, sliding the base into place, bolting the base to the floor, and bolting the motor to the base.

Several styles of pivoted motor bases are available. The

Kelley Hacksawing Machine

A hacksawing machine of simple design, equipped with a new type of relieving mechanism, has recently been placed on the market by the Kelley Gear & Tool Co., 1406 W. State St., Bristol, Tenn. Relieving is accomplished by means of a cam cut on the main crank disk, which works in conjunction with a friction clutch that rolls a pinion up a rack. The saw is raised at one end of the stroke and lowered at the other end. It never drags on the non-cutting stroke, and the amount of lift is adjustable.



Kelley Hacksawing Machine Equipped with New Type of Relieving Device

The feed is by gravity, weights being added to increase the feed. A 20-pound weight is furnished with each machine, but weights up to 60 pounds can be added if necessary. The vise jaws are made to swivel, so as to permit cutting to angles. The saw yoke hangs centrally and is balanced in the guide. A pump located in the base supplies coolant to the back of the work, so that on the cutting stroke, the blade pulls the fluid through the work and provides for cool cutting.

This machine is designed to use 12- or 18-inch blades. It will saw stock up to 10 by 10 inches. The one-horsepower motor drives through three-step V-belt pulleys and a planetary gear reducer. Six speeds ranging from 80 to 126 R.P.M. are obtainable.

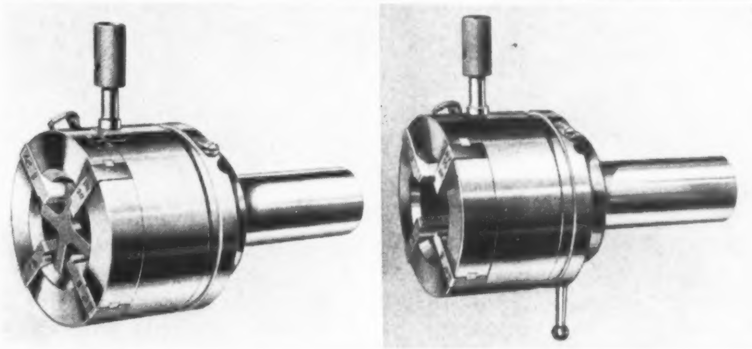
Houghton Metal Cleaners

E. F. Houghton & Co., 240 W. Somerset St., Philadelphia, Pa., announces a line of metal cleaners known as the "Houghto-Clean 100 Series," which replaces an earlier series of the same name and covers a wider range of operations. The new series includes nine compounds for light, medium, and heavy-duty cleaning. They will remove all kinds of oils and greases—animal, vegetable, and mineral. One grade is especially intended for cleaning after carburizing operations.

These cleaners are adaptable to tank, high-pressure washing, steam-gun, electrolytic, and other processes. They leave metal surfaces in the proper condition for japanning, galvanizing, electroplating, lacquering, and other finishing operations.

Geometric Die-Heads with Convertible Tripping Mechanisms

The line of Style C self-opening die-heads made by the Geometric Tool Co., New Haven, Conn., has recently been redesigned in such a way that it is possible to convert one whole series of tools from an inside-trip die-head to an outside-trip tool or vice versa. This conversion can be easily made through the purchase of only two or three inexpensive parts. Thus, the two die-heads shown in the accompanying illustration are the same, with the exception that one is arranged with an inside trip and the other with an outside (lever) trip.



Geometric Die-heads which can be Converted from Inside-trip to Outside-trip Types or Vice Versa

The inside-trip die-head is recommended for use on work that must have a uniform thread length, but that is so irregular in shape that it is impossible to chuck it uniformly. The outside-trip head is employed in cutting fine-pitch threads or threads of short length when it is desirable to relieve the chasers and the thread of all stresses in the tripping action.

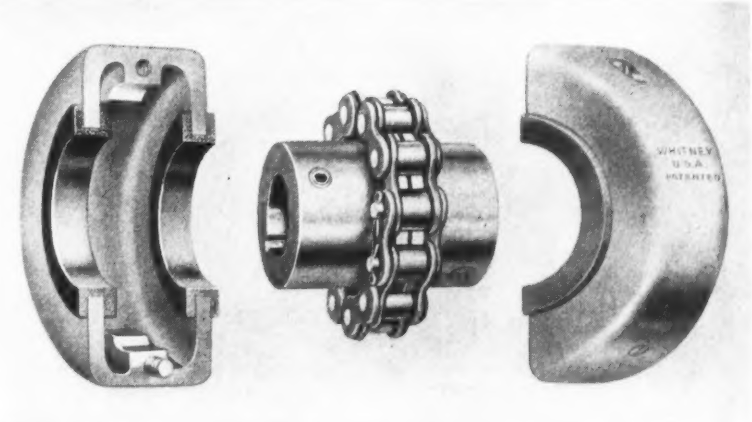
The Style C pull-off trip die-head has also been redesigned. These die-heads are all made of alloy steel. Twenty-three sizes and types, with a cutting range of from 3/8 inch to 6 inches, inclusive, are carried in stock. Other sizes and types ranging up to 10 inches in diameter can be supplied on special order to meet requirements.

Whitney Improved Roller-Chain Flexible Coupling and Cover

Improvements have recently been made in the roller-chain flexible coupling and its cover produced by the Whitney Chain & Mfg. Co., Hartford, Conn. The construction of this coupling was described in September, 1933, MACHINERY, page 60. The improved coupling is made with a wide chain, so as to provide maximum chain-roll and sprocket-tooth bearing area, thereby insuring greater coupling life. The single chain design allows the shearing stresses to be taken by the combined cross-section of the chain pin, bushing, and roll. This provides maximum strength.

The improved coupling cover is provided with lugs on each half. These lugs, which may be seen in the illustration, grip the chain roll and drive the cover positively. The cover insures proper lubrication of the coupling. It is equipped with leather grease-retaining washers, which also serve to align the cover. Oil-tight gaskets are cemented to the cover halves. The halves are held together by machine screws and lock-washers.

These couplings are available in a wide range of sizes, with capacities ranging from 1 horsepower to several hundred horsepower.



Whitney Roller-chain Flexible Coupling and New Type of Cover

Murex Heavy-Coated Electrode

A heavy-coated electrode known as Murex Type N has been brought out by the Metal & Thermit Corporation, 120 Broadway, New York City, for arc-welding operations where there are gaps to be bridged because of poorly fitted plates. In the smaller size, this electrode can also be used on vertical and overhead work or for making rapid single-pass welds on materials of light gage. Clean and sound single- or multiple-pass fillets can be made. The tensile strength of the metal deposited by this electrode is said to range from 74,000 to 84,000 pounds per square inch.

Cincinnati High-Speed Universal Milling Attachment

A high-speed universal milling attachment of the type here shown is made by the Cincinnati Milling Machine and Cincinnati Grinders, Inc., Cincinnati, Ohio, in sizes to fit the L type, MH, and dial type milling machines built by that concern. This attachment is especially suitable for tool-room and light production work that requires the use of small milling cutters, drills, or boring tools.

The attachment spindle can be swiveled 360 degrees in a plane parallel to the face of the machine column, and 90 degrees in a plane at right angles to the column face. Graduations around the circumference of the housings enable accurate angular settings of the cutter to be made. There are four clamping bolts in each swiveling element to insure that the spindle will be held firmly in position.

The attachment is driven direct from the machine spindle by means of a splined shaft that fits into an adapter. This adapter is driven by the arbor driving keys, and is centered from the spindle. It will be observed from the illustrations that the attachment is supported by the over-arm of the machine. This construction makes the complete cross range of the machine available. All gears and shafts of the attachment are made of heat-treated alloy steel, and the drive is provided throughout with anti-friction bearings.

A quill feeding mechanism, crane for handling the attachment (see Fig. 2), and quick-change adapter for the spindle nose may be provided. Contrary to the usual practice, the quill device may be installed by the customer at any time after the attachment has been purchased.

The speed range of the attachment varies with the different machines to which it is applied. For example, on the Nos. 2-11 and 2-MH milling machines, the speed range is from 40 to 2000 revolutions per minute, while on Nos. 3 and 4 medium-speed dial type milling machines the speed range is from 60 to 1500 revolutions per minute. The maximum and minimum distances from the center of the attachment spindle to the face of the column are 18 15/16 and 11 15/16 inches, respectively.

Greenerd Hydraulic Press with Upper and Lower Rams

A hydraulic press equipped with a ram that operates through the table in conjunction with the regular overhead ram has been developed by the Edwin E. Bartlett Co., Nashua, N. H. This machine is intended for assembling, clamping, and riveting operations. When the control lever is tripped for an operation, the top ram descends and exerts about 90 per cent of the predetermined pressure, which may be between 1 1/2 and 10 tons.

Then the bottom ram automatically makes an upward stroke, applying about one-third the pressure exerted by the top ram. When the bottom ram reaches the work, the maximum pressure of both rams is instantly applied and maintained until the control lever is released. A stop-rod regulates the travel of the top ram in both directions.

Fig. 1. Universal Milling Attachment Designed for Application to the Over-arm of Cincinnati Milling Machines

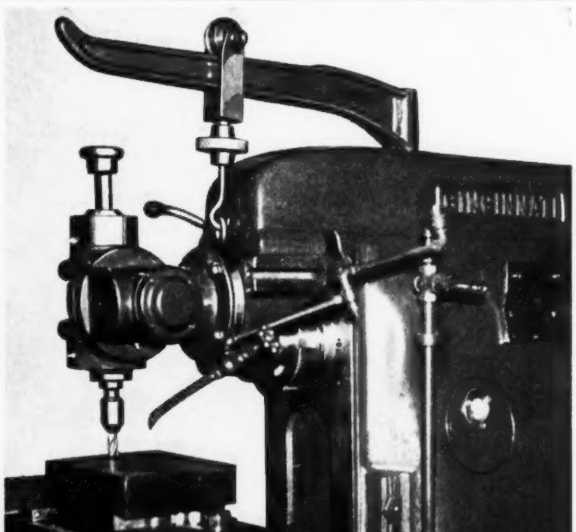
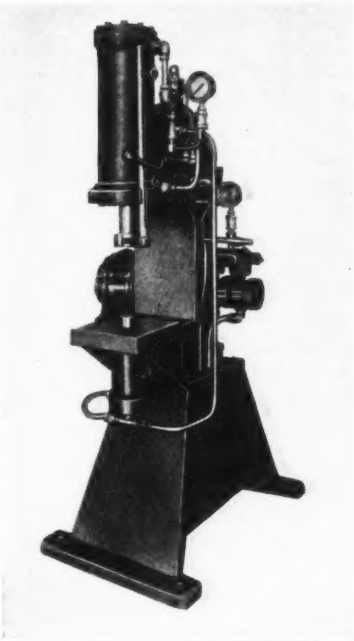
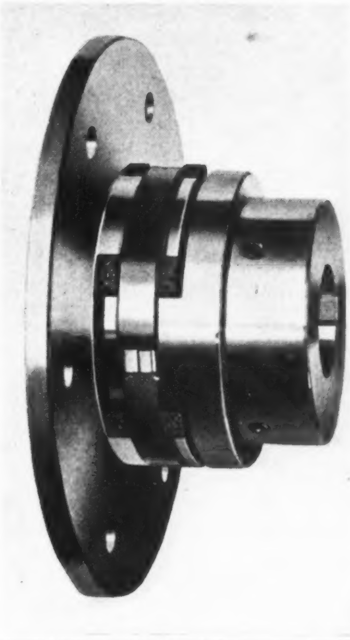


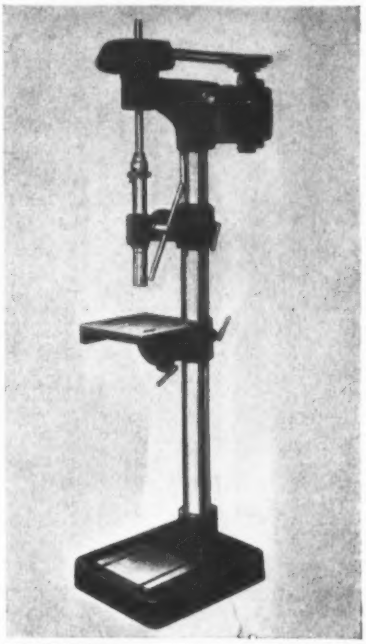
Fig. 2. A Crane, Quill Feeding Mechanism, and Quick-change Adapter can be Provided for the Universal Milling Attachment



Hydraulic Press with Two Opposed Rams



L-R Flexible Coupling Reduced One-third in Length



Buffalo Sensitive Drilling Machine of Improved Design

The press is operated by a three-horsepower motor and a hydraulic pump, mounted on opposite sides of the column. The pump is connected to a 20-gallon sump in the base. The stroke of the top ram is adjustable from 1 to 16 inches, while the bottom ram has a 1 1/2-inch stroke.

L-R Flexible Coupling Designed for Compactness

A one-third reduction in the over-all length of a Type WF flexible coupling brought out by the Lovejoy Tool Works, 5021 W. Lake St., Chicago, Ill., was made possible by designing one of the bodies in the form of a flange which can be bolted to the flywheel, clutch, or brake-drum of a Diesel, gasoline, or steam engine. A recently installed coupling of this type, capable of carrying 324,000 inch-pounds, extends less than 6 inches beyond the flywheel rim. This allows considerably more space for the frame and other parts at an important point. This Type WF coupling will be made in sizes having bores from 3 to 14 inches, suitable for transmitting up to 2500 horsepower at 100 revolutions per minute.

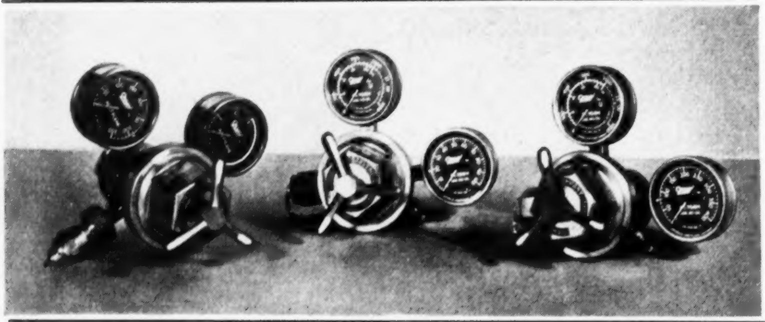
As on the Type W flexible coupling manufactured by the same concern, free-floating load cushions are held in place by a quickly removable outside retaining spring. This permits large hubs and large load-carrying surfaces. The load cushions are always in plain sight and can be removed and replaced in a few minutes' time without disassembling the coupling.

Three types of resilient cushioning material are available, including Metalflex, a high-grade long-wearing brake lining material used to withstand heavy shock loads, as on excavating machinery, steel mill equipment, and machines exposed to extreme weather conditions. Leather load cushions made of oak-tanned belting leather can also be supplied for use on sustained loads and on applications where there is a great amount of misalignment. Multiflex cushions, made of a rubber duck fabric and vulcanized under a high pressure, are supplied for use on fluctuating loads and on applications where high resilience is required.

Buffalo Sensitive Drilling Machines

A line of No. 16 sensitive drilling machines now being placed on the market by the Buffalo Forge Co., Buffalo, N. Y., includes machines with from one to six spindles. Special adaptations can be supplied to meet the requirements of quantity production. All machines of the line are constructed of castings that have been redesigned for greater weight and improved appearance.

One of the new features is an automatic tapping control that can be provided for operation in conjunction with the hand-feed lever. When the control-equipped lever is moved forward to advance the tap into the work, the motor is caused to run in the forward direction. At the instant, however, that the lever is moved backward, the spindle begins to run in the reverse direction. This design makes it convenient to reverse the tap frequently in an operation to clear it of chips. For taps smaller than 3/8 inch, an attachment is provided to fit the spindle nose.



Oxweld Regulators for the Accurate Control of Oxygen and Acetylene Pressures in Cutting and Welding Operations

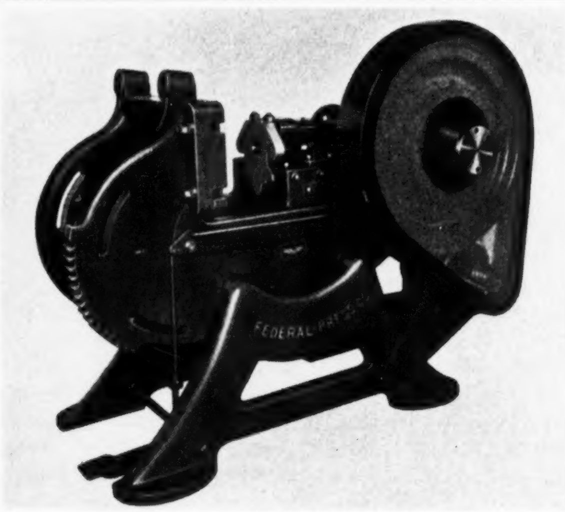
Oxweld Oxygen and Acetylene Regulators

Three new regulators for accurately controlling the pressure of oxygen and acetylene through the entire range of welding and cutting operations have been announced by the Linde Air Products Co., 30 E. 42nd St., New York City. These regulators are of two-stage construction. The Type R-64 oxygen regulator is for welding and cutting operations requiring oxygen pressures up to 75 pounds per square inch. The Type R-65 oxygen regulator is designed for heavy-duty cutting operations which may require oxygen pressures as high as 200 pounds per square inch, but this regulator can also be used for welding operations when the need arises. The Type R-66 acetylene regulator is a companion piece for either of the oxygen regulators and is intended for all welding and cutting operations.

One of the important details of design of these regulators is that the valves are stem-operated and close with the incoming pressure, not against it. Sensitive rubber diaphragms and self-contained first-stage valves are important improvements. The bodies and caps are pressure-forged to insure strength. The dials of the pressure gages are colored and the calibrations are silvered to make them easily read. The point of the pressure adjusting screw is cradled in three ball bearings, so as to preserve alignment and provide finger-tip regulation through its full range.

Federal Horizontal Open-Back Inclinable Press

An open-back inclinable press of horizontal design has recently been added to the line of the Federal Press Co., Elkhart, Ind. This press is especially suitable for the application of automatic roll or pinch feeds. It is equipped with an improved built-in, non-repeat, sliding-key clutch mechanism. The flywheel runs on Timken roller bearings, which eliminates former clutch troubles.



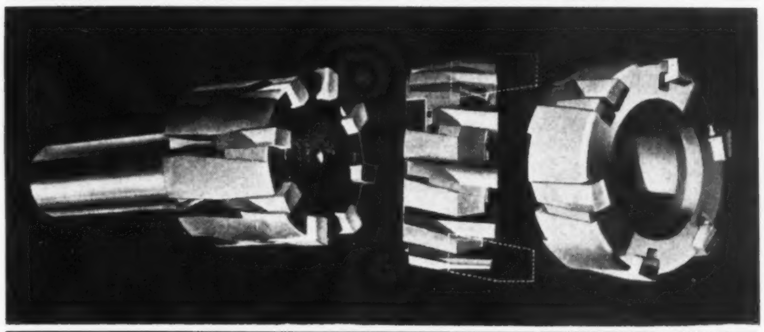
Federal Horizontal Open-back Inclinable Press

The press can be furnished with a patented brake release and with bronze bushings in the main and crank bearings. The standard machine is equipped with a bolster plate, an upper knock-out bar in the ram, and a knock-out bracket on the frame. The ram guides are of unusual length, and are fitted with gibs for adjustment from either side, so as to insure correct alignment at all times. The machine can be supplied with a direct V-belt motor drive or it can be arranged to be driven from a line-shaft.

Lincoln Electrode with High Weld Strength

Welds with tensile strengths of approximately 100,000 pounds per square inch can be made with a "Shield-Arc 100" electrode just announced by the Lincoln Electric Co., Cleveland, Ohio. This is a heavily coated electrode of the shielded arc type, intended for welding steels having somewhat higher ultimate strengths than those ordinarily welded with "Shield-Arc 85" electrodes. In the "as welded" condition, the ductility of welds is from 12 to 18 per cent elongation in 2 inches. The chemical composition of the plate being welded of course affects the properties of the weld. When stress relieved, welds in mild steel possess ultimate strength of 110,000 to 115,000 pounds per square inch, yield point of 95,000 to 105,000 pounds per square inch, and ductility of 18 to 22 per cent elongation in 2 inches.

This new electrode is suitable for flat, vertical, and overhead welding, and is available in 1/8-, 5/32-, and 3/16-inch sizes. For most vertical and overhead welding, the 1/8- and 5/32-inch sizes are preferred; however, the 3/16-inch size can be used for making vertical welds in thick plate.



Ingersoll "Ray-Blades" Have Now been Applied to Core Drills and Reamers, in Addition to Face Milling Cutters

Ingersoll "Ray-Blade" Core Drills and Reamers

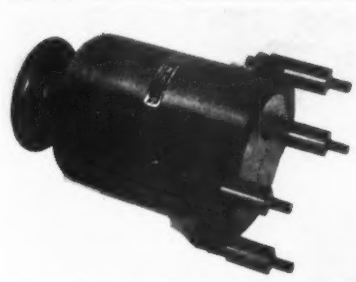
"Ray-Blades," made by the Ingersoll Milling Machine Co., Rockford Ill., for application to face milling cutters, have now also been applied to core drills and reamers made with a solid shank or in the shell type. The double-tapered "Ray-Blades" are positively locked against the thrust of the cut. When worn, they can be easily reset any amount, being moved outward for resizing purposes and forward in order to compensate for the major wear of end cutting.

These blades are locked in the cutter housing by means of compensating serrated wedges. Each blade is tapered along its length, so that it will not push down or back from the thrust of the cut. It is further tapered across its width to prevent it from pulling out of its locating slot.

Boring heads are furnished with "Ray-Blades" made of high-speed steel, super high-speed steel, Stellite, and cemented carbide. The simple shape of the blade makes it particularly economical for the application of Stellite.

Dayton Rogers Universal Pneumatic Die Cushion

A combination drawing and stripping die cushion of improved design is being placed on the market by the Dayton Rogers Mfg. Co., 1845 E. Franklin St., Minneapolis, Minn. This cushioning device is contained in a heavy cast-iron alloy cylinder which may be clamped directly to the bolster plate of a press for shallow drawing purposes. Also, by the use of spacing studs, the unit may be mounted clear of the bolster plate for compound blanking purposes.



Dayton Rogers Combination Drawing and Stripping Die Cushion

The long piston, which has a hardened and ground top face to receive draw-ring pins, is guided by a large stem which protrudes through the bottom of the cylinder. The threaded end of this piston stem is provided with an adjustment handwheel that may be used to predetermine the height of the piston face when the piston is at rest. This eliminates the necessity of correcting the length of draw-ring pins or stripper rods on compound dies. The handwheel adjustment is not only of advantage on drawing dies, but it is also convenient for adjusting the stripper to the correct height after the compound punch has been ground, thus insuring the correct height of the stripper in its free or idle position.

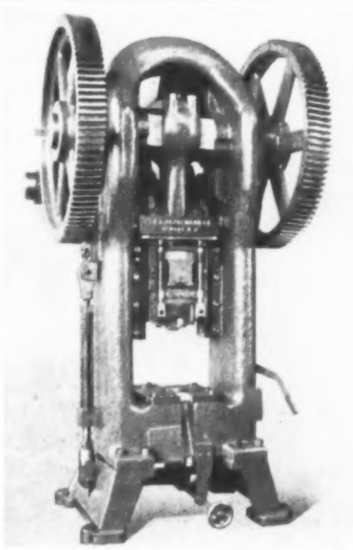
Each pneumatic cushion unit is self-contained and consists of an individual air chamber which receives air directly from the line; consequently, the necessity of auxiliary air tanks is eliminated. Each unit is also provided with a pneumatic hose connection from the regulating valve and a pressure gage.

This universal cushion is offered in five sizes, with piston diameters of from 4 to 12 inches and working pressures from 1/4 ton to 5 tons on air-line pressures of from 20 to 150 pounds per square inch.

Zeh & Hahnemann Straight-Sided Press

The straight-sided press here illustrated, which has a capacity of 200 tons, has recently been built by the Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J. The frame and pitman are solid steel castings which, together with a wedge adjustment, provides a rigid construction. An ordinary ball-screw adjustment can also be furnished.

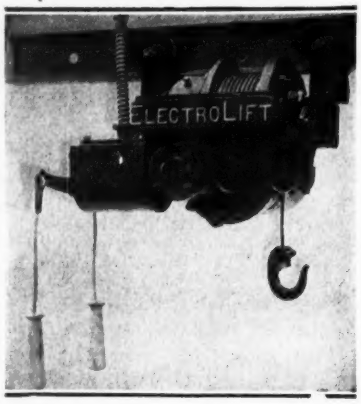
This press has a normal stroke of 4 inches and a maximum stroke of 12 inches. Twin spiral



Zeh & Hahnemann Press of 200 Tons Capacity

gears are used for the drive and a "Twin Disc" clutch is the engaging means. The back-gear shaft runs in Hyatt heavy-duty bearings.

The distance between the pillars is 25 inches; the bed area is 22 inches square; the speed of the back-shaft is 360 revolutions per minute; and a 10-horsepower motor is required. The machine weighs approximately 12 tons.



Electro-Lift Hoist, Built in 250- and 500-pound Capacities

Electro-Lift High-Speed Close Head-Room Hoist

A high-speed Junior type hoist designed to meet service conditions of close head-room is being built in sizes of 250 and 500 pounds by Electro Lift, Inc., 30 Church St., New York City. These hoists are particularly suitable for the rapid handling of small loads in quantity production operations. In automobile plants, for example, they are being used for such operations as lowering engines, radiators, and other parts into automobile chassis along assembly lines; for loading and unloading freight cars; and for serving conveyor lines. They are also being used over pickling and dipping tanks.

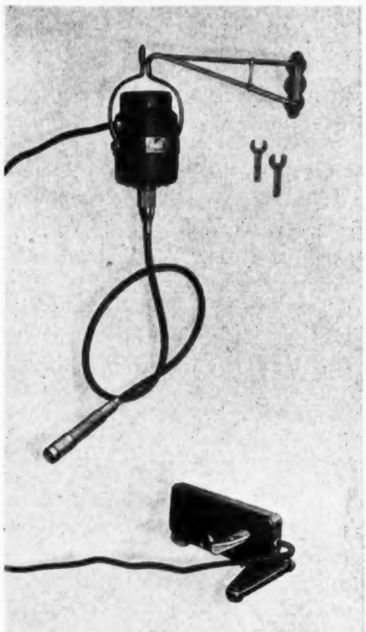
They are driven by worm-gearing which runs in Timken tapered roller bearings, the drive being fully enclosed and operating in an oil bath. Ball bearings are provided for the motor, and the motor is attached directly to the hoist frame, which gives a compact design. The control may be either by rope or push-button.

Fafnir Roller-Bearing Pillow Block with Ball Thrust Bearing

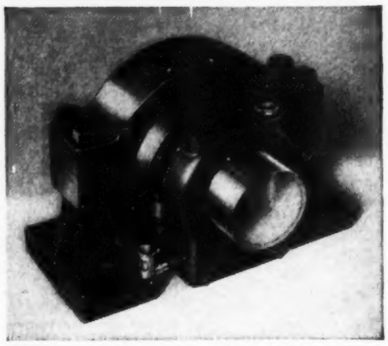
A roller-bearing pillow block designed for service involving a heavy end thrust, in addition to the radial load, is now being manufactured by the Fafnir Bearing Co., New Britain, Conn. In this pillow block there is a separate heavy-duty ball bearing which takes all the forces that tend to displace the shaft axially. The entire radial load is, of course, taken by the roller bearing.

A spherical housing construction which provides self-alignment, as in the case of other Fafnir roller-bearing pillow blocks, is another feature of the design. The housing is of the two-part type, which simplifies assembly. It is oil-tight and is equipped with a leveling device for oil lubrication. The cage is of unusually sturdy construction.

The roller bearing is of a type recently developed, in which an increased number of solid rolls are employed, so as to obtain maximum load capacity. These pillow blocks are now available for shaft sizes ranging from



Themac Flexible Shaft Tool with Five-speed Foot Control



Roller-bearing Pillow Block with Ball Thrust Bearing

3 5/16 up to 10 inches. They have radial load capacities up to 250 tons.

Themac Flexible Shaft Tool

Flexible shaft equipment for performing grinding, drilling, and other operations in making various types of dies or molds for synthetic plastics is being introduced on the market by the McGonegal Mfg. Co., 228 Orchard St., East Rutherford, N. J. This new equipment, which is designated Type 1300, may be provided with six different hand-piece combinations, including a dental type; an oilless bearing type fitted with a Themac chuck; a plain bearing type provided with either a Jacobs or a Themac chuck; and a ball bearing type with either a Jacobs or a Themac chuck. These hand-pieces are interchangeable and have a capacity for tools with shanks up to 1/8 inch in diameter.

A feature of all the hand-pieces is the provision of a sliding guard that is pushed forward over the chuck in operation. Thus the user can hold the hand-piece as close as possible to the work.

The motor is of 1/10 horsepower capacity, and is of the universal style, which operates on either alternating or direct current of the same voltage. It is of a sealed ball-bearing design and has an external ventilating fan that insures cool perform-

ance. The motor has an idling speed of 14,000 revolutions per minute. It is intended for suspension from a wall bracket, as shown. A five-speed foot control and flexible shafting made by the S. S. White Dental Mfg. Co. are standard equipment.

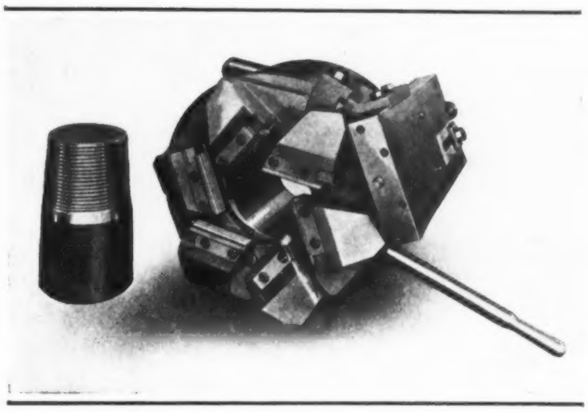
This flexible shaft tool has been found especially advantageous in finishing forging dies, because of the deep narrow impressions that are prevalent in that class of work. Another application is to mount the handpiece rigidly in the toolpost of a lathe for internal grinding.

Chambersburg Pneumatic Hammer

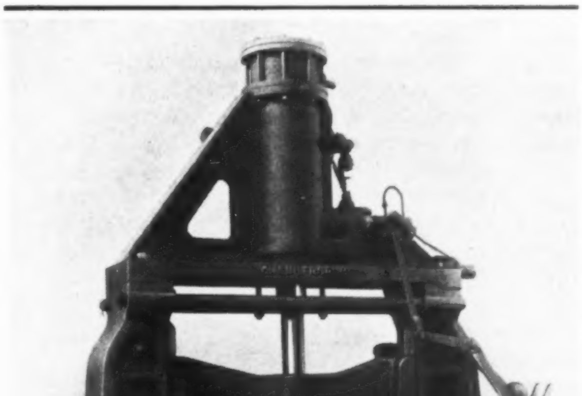
A pneumatic hammer designed primarily for production operations in airplane factories in the making of such parts as wings, fuselages, and sheathing has recently been brought out by the Chambersburg Engineering Co., Chambersburg, Pa. This machine is intended for high-speed operation on the normal shop supply of compressed air, pressures from 75 to 100 pounds per square inch being suitable. The cylinder is smaller than the size usually fitted to a steam- or air-operated hammer, and the ram is of a light-weight ribbed design. The ram weight can be adjusted and the general design modified to accommodate any particular shapes to be handled. The ram can be operated by the hand-levers at the right or by a treadle so placed as to provide maximum visibility of the work.

An important advantage of this machine is that after a blow has been delivered, the pressure can be maintained for any desired length of time with the ram or upper die in contact with the work.

Pneumatic hammers of this type can be built for work of any size. They will perform almost any forming operation required in airplane fabrication.



Landis Die-head which will Cut Tapered Threads up to 6 Inches in Diameter



Chambersburg High-speed Pneumatic Hammer Designed Especially for Use in Airplane Factories

Landis Taper-Cutting Die-Head

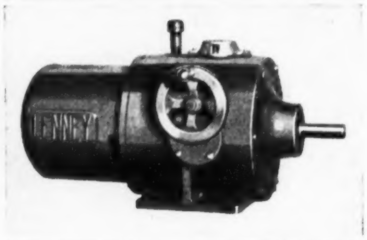
A special heavy-duty die-head for cutting threads of large diameter, steep taper, or extra length has been added to the line manufactured by the Landis Machine Co., Waynesboro, Pa. Known as the "Special 6-inch Landmatic," this die-head augments a line heretofore manufactured with a taper attachment in sizes up to 4 inches.

The new die-head is of the six-chaser type, and was designed for threading parts that are used in the oil industry, such as tool joints and drill stems. It is of a stationary type, adapted for use on a heavy-duty turret lathe. An adjustable bar, mounted on some stationary part of the machine, is required to retard the cam-carrier as the head advances on the work. This adjustable bar should be set to come into contact with the cam-carrier just as the die-head moves on the part to be threaded.

The sliding movement of the cam along the cam-shoe causes the chasers to recede at a uniform rate, so that they produce a tapered thread corresponding with the taper of the cam. The head opens automatically when the cam trips off the end of the shoe. Before the head is closed, the carriage must be returned a sufficient distance to clear the stop-bar. The adjustment for thread length limits the forward travel of the cam-carrier and insures threads of uniform diameter and length.

This die-head can be supplied for cutting threads to various diameters, tapers, and lengths. While primar-

ily designed for cutting threads of a certain size—6 inches outside diameter, 4 per inch, 2 inches per foot, and 5 inches in length—the same die-head can be adapted for cutting threads of 5 1/2 inches outside diameter, 4 per inch, 3 inches taper per foot, and 4 3/4 inches in length, or threads of 4 5/8 inches outside diameter, 4 per inch, 3 inches taper per foot, and 4 inches in length.



Lenney Variable-speed Transmission of Compact Design

Lenney Variable-Speed Transmission with Built-In Motor

The Lenney Machine & Mfg. Co., Warren, Ohio, has brought out a variable-speed transmission which differs from the one described in November, 1936, MACHINERY, page 226, in that, instead of being driven by a standard motor connected to the unit by means of a flexible coupling, a specially designed built-in motor is provided. The rotor of this motor is provided with a hub in which there is a Morse taper socket which fits a hardened and ground shaft of corresponding taper extending from the transmission. A castellated nut locked with a cotter-pin insures that the armature will stay in place.

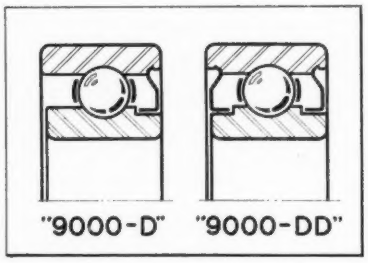
This improved construction has shortened the over-all length of the one-horsepower unit 10 inches. There has also been a reduction in weight of 4 pounds. The armature is provided with a built-in fan which ventilates the motor by drawing air through the left-hand end and discharging it through slots adjacent to the transmission body.

Norma-Hoffmann Self-Sealed Feltless Precision Bearings

The Norma-Hoffmann Bearings Corporation, Stamford, Ct., has announced a 9000 series of self-sealed precision ball bearings. These bearings are offered in two types, the 9000-D which has a single side shield, and the 9000-DD which has two side shields. These bearings are provided with inwardly extending closely fitted flanged shields which do not rotate or contact with rotating seal parts. The shields are equally effective in retaining grease with the bearing in either the horizontal or the vertical position, and not being subject to wear, they maintain their efficiency permanently.

The metal seals clear the recess on the inner ring, obviating the possibility of drag or frictional resistance. They occupy less space within the bearing than the standard felt seal. There is therefore greater grease capacity and a longer lasting supply of lubricant for continuous service. The 9000-DD bearings are sealed against the entrance of dirt or other foreign matter during assembly, operation, or disassembly, thus insuring cleanliness at all times.

These bearings are available in a full range of sizes and are interchangeable with single felt-seal bearings of the wide outer-ring type from 6 to 26 millimeters (0.2362 to 1.0236 inches) in bore diameter.

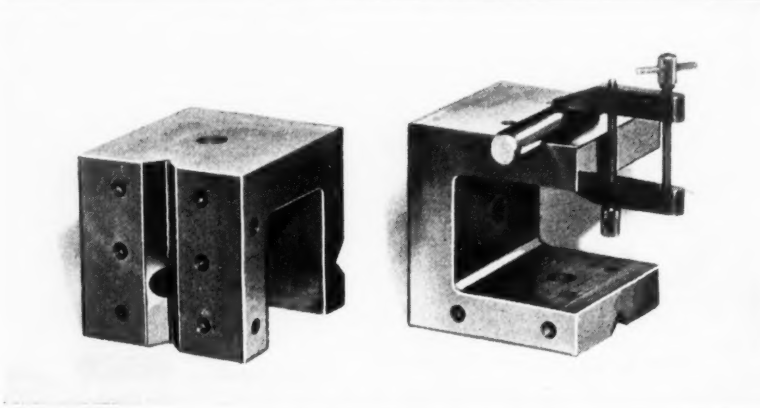


Design of Norma-Hoffmann Self-sealed Feltless Bearings

AFO Combination Angle-Plate and V-Block

A combination angle-plate and V-block for the use of toolmakers and inspectors has recently been designed by Albert F. Ouellet and is being manufactured by F. Swanson, 203 Lafayette St., New York City. This "Angle-Block" is machined from a solid bar of machine steel, and is then pack-hardened and ground so that all sides are either parallel or at right angles to each other.

A vertical vee is ground in one side of the "Angle-Block" and a horizontal vee in another side for the accurate holding of cylindrical pieces that are to be ground, drilled, or otherwise machined. Tapped holes facilitate the clamping of work by means



Combination Angle-plate and V-block for the Use of Toolmakers and Inspectors

of set-screws and straps. Parallel or C-clamps may also be employed. A hole in the center of one of the vees permits drilling completely through a clamped piece.

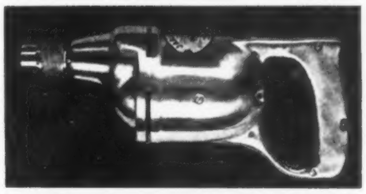
The top surface of the angle-plate is flat and facilitates the measurement of short parts by means of a height gage. The dimensions of the "Angle-Block" are approximately 2 1/2 by 2 1/4 by 2 1/4 inches.

Mercury Skid-Carrying Trailer

A trailer designed to link together the lift-truck skid and tractor-trailer systems of material handling is being placed on the market by the Mercury Mfg. Co., 4118 S. Halsted St., Chicago, Ill. Corrugated box skids with cut-away supports can be picked up at either end or side by means of a lift-truck, as shown in the illustration, and deposited on the steel-plate bolsters of the trailer. The truck can lower loaded skids on the trailer from either side or from the rear end.

The trailer is equipped with load and caster wheels of the molded-on rubber type, the wheels being 10 and 12 inches in diameter, respectively. They are equipped with Hyatt roller bearings. Alemite-Zerk fittings are provided for lubricating the wheels and casters. The running gear is protected by heavy plate guards.

The trailer is furnished with a standard hook hitch and towing eye. It has an over-all width of 38 inches, length of 66 inches (excluding the coupler), and height of 22 inches. Box skids 66 inches long, 40 inches wide, and 24 inches deep can be accommodated. These various dimensions are, however, subject to variation. The capacity of the trailer is from two to three tons. It can be used with an 11-inch truck trailing axle.

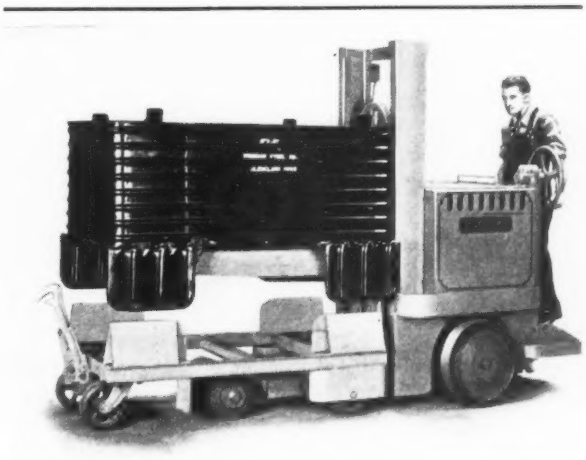


Jasco Light-weight Quarter-inch Drill

Jasco 1/4-Inch Portable Electric Drill

The 1/4-inch Junior portable electric drill here illustrated is the latest addition to the products of the James Clark, Jr., Electric Co., Louisville, Ky. This drill weighs only 3 3/4 pounds and has an over-all length of 10 1/2 inches. It has been designed especially for use in repair shops, garages, and maintenance departments where its use is intermittent.

The motor is of the universal type, operating on either alternating or direct current. It is air-cooled by a fan and slotted ducts. The armature bearings are made of graphite-impregnated bronze. The spindle revolves in a grease-lubricated bronze bearing, and is equipped with a ball bearing for taking thrust loads. The drill is made to run at a free speed of approximately 2000 revolutions per minute. The switch is of an improved type.



Mercury Trailer Designed for Carrying Skids Loaded by a Combination Lift-truck and Tractor

Machining Zinc Die-Castings

To determine the best general practice for machining zinc-alloy die-castings, the New Jersey Zinc Co. sent out questionnaires to men whose experience made them well qualified to give advice on this subject.

For tools in lathes and boring machines, high-speed steel is satisfactory. Occasionally, on high-production jobs, or when extreme accuracy is required, a cemented-carbide tool is justified. A rake angle of between 15 and 20 degrees is satisfactory. The cutting angle ranges between 62 and 69 degrees; one man uses an 82-degree cutting angle. Clearance angles of from 6 to 10 (and even up to 20 degrees for high-speed operations) are used.

Milling cutters of high-speed steel seem to be satisfactory with angles approximately the same as for working brass. One correspondent advised "considerable rake on the cutting edge."

Ground high-speed steel taps appear to be most generally used, although for sizes less than 1/4 inch, plain carbon tool steel taps are used. For taps less than 5/16 inch in diameter two flutes are generally used, while for taps of larger diameter three and four flutes give a smoother thread.

Drills of regular carbon tool steel are generally satisfactory, although for large diameters, high-speed steel tools are sometimes desirable. Plenty of clearance seems important, and in cases of deep drilling or very high speed, a polished flute helps prevent clogging of chips. A rigid spindle without end play in the thrust bearing seems necessary to prevent gouging when the drill breaks through.

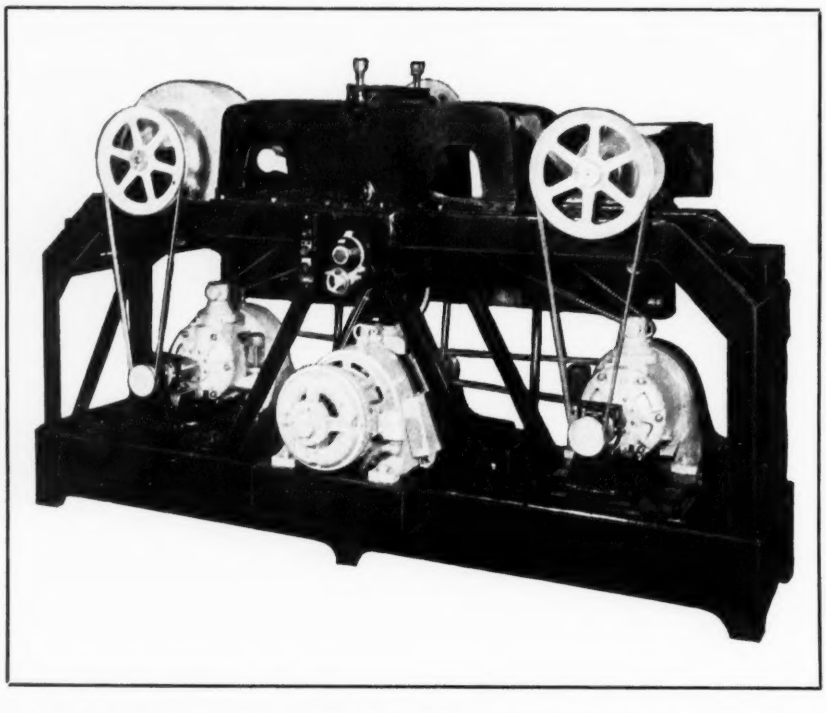
Two recommendations for a lubricant were made: (1) Three parts mineral oil and two parts kerosene; (2) a fuel oil known as "32-36" furnace oil.

New Departure Transitorq with Dancer-Roll Control

A machine exhibited by the New Departure Division of the General Motors Corporation, Bristol, Conn., at the National Power Show held last month in New York City demonstrated the simplicity with which a constant tension may be maintained on a material in winding operations by the application of a Transitorq variable-speed transmission with a dancer-roll control. A dancer-roll is inherently a tension control effected by means of a weight applied to a continuously running material.

As an example, assume that it is desired to process material at a given speed. With a constant speed of the winding drum, the surface speed of the material being wound will increase as the roll of material increases in diameter. If there is no compensation for this, the tension on the material may be built up to such a point that the material will become damaged.

To correct this condition on the machine demonstrated, the speed control of the interposed Transitorq was connected to a dancer-roll which rested on the material. As the coil diameter increased, the material tightened and caused the dancer-roll to move upward. This movement actuated the Transitorq speed control mechanism and adjusted the speed of the winding drum. Materials of different types, requiring a wide variance in processing speeds, could be handled by a machine designed on this principle.



New Departure Exhibition Machine which Demonstrated the Possibilities of a Transitorq and Dancer-roll Control

Japanese Machinery Imports

According to a report published by the Machinery Division of the Bureau of Foreign and Domestic Commerce, the machinery imports into Japan increased from approximately $18,000,000 in 1933 to $30,000,000 in 1935. Figures for the first eight months of 1936 indicate that imports continue at a high level.

Most of the machinery imported into Japan is supplied by the United States, Germany, and Great Britain. The United States now furnishes 40 per cent of the imports; Germany, 28 per cent; and Great Britain, 18 per cent. The share of the United States has increased since 1933, when it supplied only 31 per cent. Among the imports in 1935, metal-working and woodworking machinery accounted for approximately $5,500,000 in 1935.

Wage-Earners' Share of Auto Plant Income

Basing its calculations upon figures published by the Bureau of Census, Washington, D. C., the Automobile Manufacturers Association announces that the proportion of wages paid out of the automobile industry's income has increased by one-third from 1929 to 1935. In 1929, the share of wages in the value added by manufacture in automobile, body, and parts plants was 36.6 per cent. In 1935, this share was 48.5 per cent. Out of the remainder —51.5 per cent—were paid all salaried employes; rent; local, state, and Federal taxes; interest and depreciation on plant and machinery; advertising; insurance; and other expenses, as well as dividends on capital invested.

Along with this increase of the wage-earners' share in the income from manufacture, the public has benefited by the reduction in average prices of automobiles—a reduction of 15 per cent. The average factory price of automobiles in 1929 was $644. In 1935, this figure had been reduced to $549. This reduction in price has been made in spite of an increase in the cost of raw materials per dollar of sales.

The annual individual wage rate in 1935, according to the Census report, amounted to $1405. Because of the lower cost of living today, compared with 1929, this wage had a purchasing power equivalent to $1750 per year in 1929; but the actual average wage in that year was only $1640, so that there has been a definite gain of about $100 in the real income of the individual worker in the automobile industry in 1935, as compared with 1929. There have also been additional increases in wage rates in the automobile industry since the Bureau of Census report was released.

* * *

According to the Association of American Railroads, of every dollar paid in taxes by the railroads about 45 cents is utilized for maintaining public schools. Just why the railroads should be expected to be such heavy supporters of the educational system is difficult to understand; but, then, taxation has largely reverted to the mediaeval conception of "getting it where it can be had," without reference to whether the community renders an equal service in return to the taxpayer.

Herman Lind Resigns as Manager of Machine Tool Builders' Association

At a meeting held in Cleveland on December 16, the directors of the National Machine Tool Builders' Association accepted with much re-

gret the resignation of Herman H. Lind as general manager of the Association, effective January 1. Mr. Lind will become executive vice-president of the American Institute of Bolt, Nut & Rivet Manufacturers, having offices in Cleveland.

Mr. Lind went with the Association in 1932. As an acknowledgment of his services, the directors passed the following resolution: "Be it resolved, that in accepting his resignation as general manager, the board of directors express to Herman H. Lind the appreciation and thanks of all the members for the high achievements attained by the Association under his leadership. Further, the directors assure him that their sincere good wishes go with him for continued success in his new undertaking."

* * *

Depreciation Reserve Policies

The Machinery and Allied Products Institute, 221 N. La Salle St., Chicago, Ill., has published a pamphlet entitled "Depreciation Reserve Policies—The Current Need for Sound and Adequate Practices," which pertains to a timely and important subject. The pamphlet contains concrete suggestions bearing upon depreciation charges, repair and replacement expenditures, capital investments, dividend disbursements, and provision for taxes. It deals specifically with effects of recent legislation on depression reserve policies, and contains the results of a study made by a committee representative of management, engineering, and accounting. Copies can be obtained from the Institute.

* * *

Industrial Expositions in 1937

The Exhibitors Advisory Council, Inc., 330 W. 42nd St., New York City, has published the 1937 Schedule of Shows and Expositions, dealing with industrial, trade, agricultural, professional, medical, and business shows, giving the names, dates, and locations of these exhibits. Copies are available at $5 each.

Training in Craftsmanship

Industry is showing an awakened interest in the training of young men for skilled and responsible work in the industrial field. Among the companies that are taking an active part in this educational work is the Cincinnati Milling Machine Co., Cincinnati, Ohio, which has a highly developed apprentice system and training school, planned along original lines in apprenticeship training.

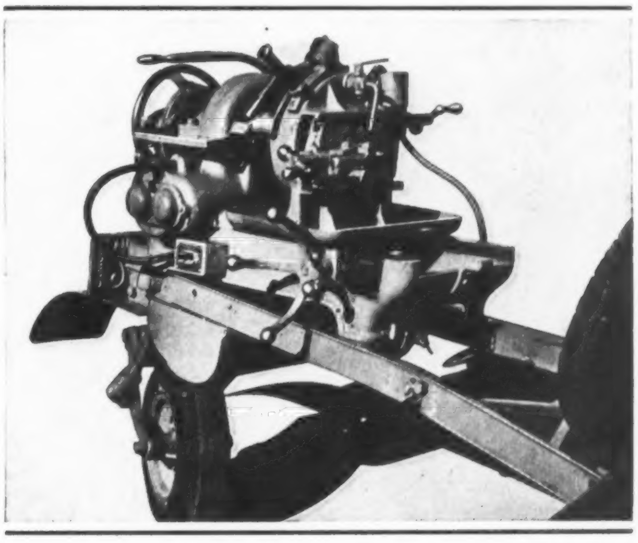
The company has just published a booklet describing in considerable detail the training courses which it provides. This booklet, entitled "The Training School," discusses first the choosing of a vocation, and emphasizes the fact that a decision on this subject must be made carefully. It then briefly reviews the history of the Cincinnati Milling Machine Co., refers to apprentice training in industry in general, and describes in detail how the company's training school functions, dealing both with the regular apprentice group and the advanced training courses.

* * *

Great Lakes Exposition to Open Again this Summer

The Great Lakes Exposition, held in Cleveland, Ohio, last summer, will open again next summer on May 29 and remain open until September 6. It will again enlist active participation of the nation's foremost industrial groups. The exposition, which was unusually well staged last summer, will have the advantage of the additional experience of the exposition management and will offer many new features.

Automobile Trailers are not Necessarily Confined to the Tourist Variety—Here is a Trailer Prepared to Thread and Cut Pipe Right where it is to be Installed. The Equipment Consists of a Red-E-Haul Portable Threader Mounted on a Frame that can be set up on Structural Legs at the Place where the Job is to be Done. This Portable Equipment was Built by the American Die & Tool Co., Reading, Pa.



Drilling Small Holes in Atomizer Nozzles

Having read with much interest the article on the drilling of small holes in atomizer nozzles in December MACHINERY, page 256, the writer concluded that MACHINERY'S readers would be interested in learning that the Taylor Mfg. Corporation, Milwaukee, Wis., has drilled a great quantity of Diesel engine nozzles for a number of Diesel engine manufacturers and thereby acquired a considerable experience in this process.

In this work, one of the Taylor Mfg. Corporation's "Hi-Eff" instruments is employed, which was developed for use in the manufacture of nozzles for the Taylor oil engine. This instrument has an extremely light-weight, counterbalanced, ball-bearing spindle that permits the operator actually to feel a 0.002-inch diameter drill cut into the material being drilled. This super-sensitive "feel" is very necessary in the economical production of small holes.

The smallest of the "Hi-Eff" machines can be used for drilling holes as small as 0.002 inch and as large as 0.065 inch in diameter. The most suitable cutting speed is obtainable through the flexibility of the drive. The speed should be varied from material to material, and also with the ratio of hole depth to drill diameter.

A coolant is sometimes used, but frequently it has been found best to omit the use of a cutting coolant. A major factor in the drilling of small holes, however, is to clear away the chips from the hole frequently by backing the drill entirely out of the hole. This not only clears the chips, but allows the drill point to cool, which is essential when using small drills. For that reason, some of these machines are equipped with an arrangement, by means of which the drill is backed out and is returned to its drilling position automatically; as a matter of fact, the whole drilling process is entirely automatic, except that the operator must set up the nozzle in the fixture. A special indexing fixture was devised for this work, making it possible to index with great accuracy, in both a horizontal and a vertical plane.

A. HUTTON, General Manager
Taylor Mfg. Corporation

* * *

The alternative to a voluntary economic system is a coercive system. There is no middle ground. A mixture of the two cannot be permanent. The extension of government authority, so long as it simply enlarges the field of voluntary agreement among free citizens, by suppressing all violence and fraud, insures the permanency of the voluntary system. Any further extension of government authority prevents the expansion of industry, throws the labor market out of balance, increases unemployment, and plays into the hands of coercionists, giving them excuses for more and more repressive legislation and causing still more unemployment until the whole structure breaks down.—*Dr. T. N. Carver in his book "What Must We Do to Save Our Economic System?"*

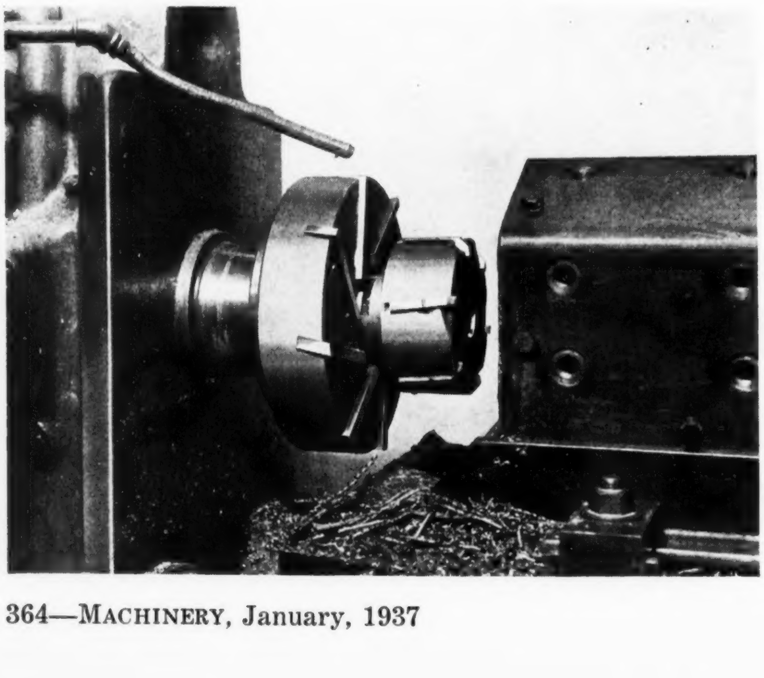
Automobile Industry Makes New Records

More motor vehicles were shipped from the factories of the members of the Automobile Manufacturers Association during November than in any previous November recorded by the industry. Factory shipments for the month amounted to nearly 377,500 cars and trucks. This was an increase of 12 per cent over November last year, and was more than double the average output for November in the last five-year period. Factory shipments for the first eleven months were approximately 3,120,000 units —a 23 per cent increase over the same period last year and an 86 per cent increase over the 1931-1935 five-year average. The Automobile Manufacturers Association includes all important automobile and truck builders except Ford.

* * *

Symposium on Alloy Cast Irons

The Northeastern Ohio Chapter of the American Foundrymen's Association has scheduled a symposium on alloy cast irons for its January 14 meeting, to be held at the Cleveland Club, Carnegie Ave. and E. 107th St., Cleveland, Ohio, at 6 P.M. Fred J. Walls, of the International Nickel Co., will discuss the advantages of nickel alloy cast irons, and will describe some applications in the automotive, machine tool, and other industries.



Rough- and finish-reaming and spot-facing a Cleveland Tractor Co.'s track frame housing on a Brown & Sharpe milling machine, using McCrosky Tool Corporation's inserted serrated-blade reamer and facing cutter, in which the blades are held by Jack-Lock wedges. Formerly, reaming head was removed to mill across with regular milling cutter; now the operations are performed progressively with a saving of 30 per cent in time